RAILROAD GAZETTE

FRIDAY, JULY 6, 1877.

MASTER MECHANICS' ASSOCIATION.

Tenth Annual Convention.

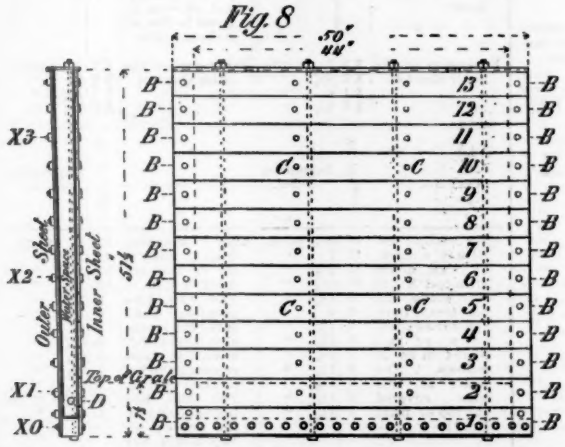
REPORT ON BEST MATERIAL, FORM AND PROPORTION FOR LOCOMOTIVE BOILERS AND FIRE-BOXES.

[Continued from page 288.]

Since writing the foregoing part of our report, the Chairman of your committee has been enabled to make some experiments on the expansion of steel in the different parts of a sheet representing a side sheet in a fire-box, under different circumstances, such as occur in the use of a boiler, except that the temperature of the water in the water space was at no time greater than 212 degrees, Fahr. If a sheet in a fire-box, say a side sheet, were cut into strips of a few inches in width, in a horizontal direction, and each strip allowed to assume a length due to its temperature without hindrance to the strips next to it, and such a change of length of the strip due to a change of temperature could be measured, then the forces developed by unequal temperature of the different parts of a sheet could be located and, to a certain extent, calculated. With this object in view, the Chairman of your committee proposed to the Otis Iron & Steel Co. that they furnish the steel plates for the purpose of making some experiments, which they very kindly did, free of cost to your committee. The plates were 4 inches wide, 50 inches long, and $\frac{5}{16}$ of an inch thick in the rough, and 15 in number; and were all cut from one sheet, of a degree of carbonization of 0.08 per cent., the same in quality as they furnish for boilers and fire-boxes. These plates were planed V shape on the edges, the V of

Fig. 7

Fig. 8



the lower edge of the one fitting into the corresponding shaped groove of the one below it, with a strip of rubber $\frac{1}{16}$ of an inch thick between the two edges to make the joint, as shown at Fig 7. The direction of the plate, as they formed this sheet, was horizontal. The sheet, made up of 13 of these plates or strips, measured 50 inches long and 51⅛ deep, each strip or plate and its rubber joint being 3⅞ in. wide when in its place. It was placed on the inner or fire-box side of a waterspace, 44 in. long, 49 in. deep, 2¼ in. wide at the bottom, and 3 in. at the top, in the clear. The outer sheet forming this water space was of steel in one piece, and 50 × 51⅛ × $\frac{5}{16}$ in., and had previously served its time as a side sheet in a fire-box. Both sheets were riveted at the bottom to a bar 2½ in. square, representing the mud ring at the bottom of an ordinary fire-box.

The ends to the water space were of yellow pine wood, 2¼ in. thick, nearly as wide as the water space, and extended from the mud ring to the top of the sheets, a strip of sheet rubber forming the joint between the sheets and the wood, making them water-tight.

Each plate had one ⅛ in. bolt through it at each end and passing through the wood end, sheet rubber, and the outer sheet, as represented in the end view, Fig. 8, and also two ⅛ in. stay bolts were tapped through each plate at equal distances between the ends, as shown at *c*, *c*, in the side elevation, Fig. 8. Four ¾ in. bolts passed through the plates forming the top to the waterspace and which rested on the top edge of both the outer and inner sheet, down through the waterspace and through the mud ring, to hold the plates composing the inner sheet together at the joints, where their edges joined tight enough to prevent leakage. A section of these joints is represented in Fig. 7; the whole being as represented by the side and end elevations, Fig. 8. A cock was placed in end of the waterspace at *D*, 2¾ in. above the top of the mud ring, and 2½ in. below the top of the grate. A fire-box was constructed, with the waterspace represented in fig. 8 forming one side of it, the sheet composed of the thirteen sheets being next to the fire, as represented in the end view, Fig. 9. This fire-box was 44 in. long, 15 in. wide at the grate, 19 in. at the top, and 41 in. deep to the top of the grate, with a grate area of 15×44 in., and a chimney 14 in. in diameter and 12 feet high. The top, the ends and one side of this fire-box were made of old boiler plate, without water spaces. The 13 plates composing the sheet of the waterspace next to the fire were numbered from 1 to 13 inches, beginning at the bottom with No. 1, which was rivited to the mud ring, as represented in figs. Nos. 8 and 9. The top of the grate was 7⅛ in. above the bottom of the mud ring, and about ⅛ in. below the top edge of plate No. 2. Plate 1, being riveted to the mud ring and the bottom edge of the single sheet which formed the outside sheet to the waterspace, was immovably fixed at that point, and could only expand and contract in the direction of its length with the parts to which it was attached, while each of the other plates, 2, 3, 4, 5, etc., were perfectly free to assume any length due to their temperature, without interference from any of the others composing this sheet, except the very slight friction of the rubber joints at their end, and where their edges joined together in the horizontal seams or joints; and as all the joints were well fitted, but little pressure from the bolts was required to make them tight, and as that was so insignificant it was unnecessary to take it into account. To measure accurately the expansion and contraction of each of the thirteen plates composing this sheet, under the variations of temperature occurring under different circumstances, a pointer with a leverage of twelve to one, and a dial graduated to twelve points to the inch, were attached to *each end of each plate*, secured to a perfectly solid and substantial frame of wood, entirely independent of the fire-box, waterspace, or any of their fastenings. This arrangement for showing the expansion and contraction of each plate is represented by Fig. 10. *E* represents the plate, 50 in. long and 3⅞ in. wide; *F*, *F*, the pointers, 12 in. long, made of dry wood; *G*, *G*, dials X attached to the timber to which all the pointers were fastened. *H*, *H* are iron rods ¼ in. in diameter and from 12 to 24 in. long, to suit the position of each pointer as fastened to the frame; the ends being pointed, the one resting in a centre punch mark in the end of the plate (shown at *B*. *B*, Fig. 8), the other in a point in the side of the pointer *F*, one inch from the screw holding the end attached to the frame. *I*, *I* are small spiral springs, bearing against the outside edge of the pointers, midway between the rods *H*, *H* and the screw in the lower end of the pointers, to take up all lost motion, and to keep the rods *H*, *H*, and the pointers to their proper bearings and places.

With the arrangement represented in Fig. 10, elongation of the plate *E* sufficient to cause the pointers to move outward from *O* one point (each pointer one-half point) will indicate that the point has increased in length the one hundred and forty-fourth part of an inch, for the reason that the end of the pointer on the dial moves twelve times as far as the rod *H*, and an inch on the dial is divided into twelve points or divisions.

As stated above, to each of the thirteen plates composing this sheet, representing a side sheet in a fire-box, was attached a pair of pointers as represented in Fig. 10. The water was in contact with each plate 44 in. of its length, and the same length of each was exposed to the action of the fire, the portion below the top of the grate excepted. Pointers, as represented in Fig. 10, were also attached to the outer sheet

Fig. 10

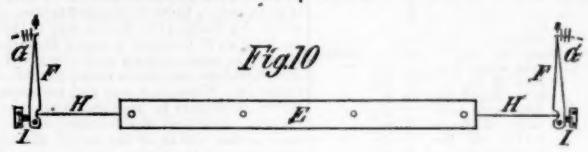
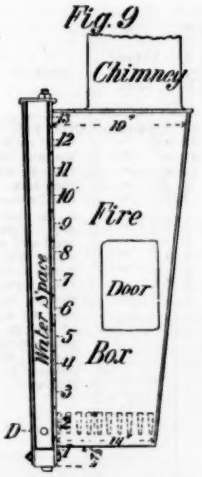


Fig. 9



forming this waterspace at points in its height represented in Fig. 8, and designated as X0; X1; X2 and X3. The pair X0 were as high as the centre of the mud ring. X1 were opposite plate No. 2, and X2 correspond in height with plate 6, and X3 with that of No. 11.

he waterspace was filled with water at a temperature of 54 degrees Fahr. The whole arrangement, as represented in Fig. 9 resting on a perfectly solid foundation, being secured and braced so as to prevent any displacement except that due to the expansion of the plates forming the waterspace.

The pointers and dials were all carefully adjusted, with the points of the former at 0 on the latter, the temperature of all the plates, and that of the water in contact with them, being, as stated, 54 degs. Fahr. Rods H, H were protected from the influence of the heat from the fire-box. A fire was then started

The tests, and circumstances under which they were made, and the results, were as follows, beginning May 4, 1877:

TEST No. 1.	No. of plate.	Expansi'n on dial.	TEST No. 2.	No. of plate.	Expan-i'n on dial.
Fire started at 8:20 p. m., and at 8:45 p. m. the pointers indicated the expansion of the different plates to be as represented in this table opposite the number of the plate.	13	5 points	With a good coal fire burning on the grate at 8:55 or 35 minutes after starting the fire, the pointers indicated the following points of expansion for the different plates.	13	7½ points
	12	7 "		12	7⅜ "
	11	8 "		11	8½ "
	10	7 "		10	8 "
	9	7 "		9	8 "
	8	7 "		8	8 "
	7	7½ "		7	8½ "
	6	7½ "		6	8 "
	5	8 "		5	8½ "
	4	8 "		4	8½ "
	3	6½ "		3	7½ "
	2	1 "		2	4½ "
	1	0½ "		1	1 "
Expansion of the outer sheet of the water space at the different points of its height, was as follows:	X3	6 points	Expansion of the outer sheet at that time was as follows at	X3	7 points
	X2	5¾ "		X2	6 "
	X1	2 "		X1	4 "

on the grate with wood, coal which had been slightly charred was afterwards added, and was in all cases used after starting the fire, in making the various tests; the results of which, and the circumstances under which they were made, are set forth in the following tables. The left-hand column giving the number of the plate, as represented in position in Fig. 8, and the right-hand column showing the expansion of the plate in length, in points, or divisions of the one hundred and forty-fourth part of an inch; the numbers as given in that column, indicating the number of one hundred and forty-fourth parts of an inch the plate has elongated from an increase of temperature above 54 degrees.

For instance, the figure 8 in that column, opposite plate No. 5, represents that plate has elongated by reason of an increase of temperature above 54 degrees eight parts of the one hundred and forty-four parts of an inch; or in other words, the one eighteenth of an inch, etc. In all cases, the number of points given is the aggregate of that indicated by the movement of the two pointers connected to the same plate. For instance, if

TEST No. 3.	No. of plate.	Expansion on dial.	TEST No. 4.	No. of plate.	Expansion on dial.
At 9.05 or 10 minutes after test No. 2 was made, the pointers indicated the expansion of the different plates to be as shown in this table.	13	8 points	At 9.20 the pointers indicated the expansion to be as follows, in the different plates	13	7½ points
	12	8 "		12	8 "
	11	8½ "		11	8¼ "
	10	8½ "		10	8¼ "
	9	8½ "		9	8½ "
	8	8¼ "		8	8½ "
	7	8½ "		7	8¾ "
	6	8¼ "		6	8 "
	5	8½ "		5	8¼ "
	4	8½ "		4	8½ "
	3	8¼ "		3	8¼ "
	2	6⅜ "		2	7 "
	1	2½ "		1	5⅛ "
Expansion of the outer sheet was at this time, at	X 3	7¼ points	Expansion of outer sheet at	X 3	7 points
	X 2	7½ "		X 2	7⅛ "
	X 1	5¼ "		X 1	6¾ "

the pointer at the one end of plate No. 6 indicates 3 points on the dial, while the one at the opposite end of the plate indicates 4¼ points, the result as shown in the column would be 7¼ points. It was found that expansion and contraction caused the plates to move slightly more in one direction than in the other, in a majority of cases; but the aggregate movement of the two pointers to each plate gave the total accurately.

It will be noticed that in Test No. 1 the expansion of plate No. 1, riveted to the mud ring, is but 0⅛ a point, and plate No.

Fig. 11

2 is 1 point, while that of No. 3 has reached 6¼ points, and No. 4 8 points, the most marked difference being between plates 2 and 3. The expansion of No. 3, which is situated immediately above the grate, is 6¼ times greater than No. 2, the plates immediately below it, and 13 times as much as plate No. 1.

When Test No. 2 was made, ten minutes after that of No. 1, plate No. 1 had gained 0¼ a point, while No. 2 gained 3⅛ points, and No. 3 but 1 point.

But little change is noticed in tests 3 and 4, except that plate No. 1 has increased in length from 2¼ to 5⅛ points owing to the increase of temperature caused by the circulation of the water after it began to boil.

The average of seven different tests made within thirty minutes of that of No. 4 showed no material difference in the expansion of the plates, except that plate No. 1 showed an expansion of 6 points, a gain of 0⅛ point.

TEST No. 5.	No. of plate.	Expansion on dial.	TEST No. 6.	No. of plate.	Expansion on dial.
The fire was then drawn, and the water run out at the cock *D* at the bottom, and as soon as the water space was empty the pointers indicated the expansion of the different plates as shown in this table.	13	5½ points	Five minutes after the water was run out, cold water at a temperature of 54 degrees was run in at the cock *D* at the bottom, until it covered the top of plate No. 12, when the pointers indicated the expansion for each plate to be as shown in this table.		
	12	5¾ "		13	4 points
	11	6 "		12	3½ "
	10	6 "		11	3 "
	9	6 "		10	2½ "
	8	6 "		9	1¾ "
	7	6 "		8	1 "
	6	5¾ "		7	1 "
	5	5¾ "		6	0¾ "
	4	5½ "		5	0½ "
	3	5¾ "		4	0½ "
	2	5¾ "		3	0½ "
	1	5½ "		2	0¾ "
				1	1¼ "
Expansion of the outer sheet at	X 3	4½ points	Expansion of outer sheet at	X 3	3 points
	X 2	5½ "		X 2	2 "
	X 1	5½ "		X 1	0¾ "

Test No. 6 shows that the lower plates contract most when cold water is run into the waterspace, for the reason that the water abstracts heat from the plates, and arranges itself according to its temperature; the hottest being nearest the top, and coolest at the bottom, the temperature of the plate corresponding with that of the water in contact with it. Plate No. 1 did not contract so much as Nos. 2 and 3, for the reason that it was riveted to the mud ring, which, containing a considerable mass of metal that a few minutes before had been covered with hot water, had not yet had time to part with so much of its heat as the smaller mass in the plates.

The results shown in test No. 7 are nearly the same as in test No. 1, showing a great difference between the expansion of plates 4 and 3, above the grate, and that of 2 and 1, below

it. It also shows that there is but very little circulation of the water below the top of the grate until downward currents are produced by the boiling of the water above it; that 33 minutes after the fire was started, and while considerable quantities of steam were thrown off from the boiling water at the top, the

TEST No. 7.	No. of plate.	Expansion on dial.
Fire was started in the fire-box at 4.50 p. m., May 5, and at 5.23, or 33 minutes after it was started, the water at the top of the water space boiled, while that drawn from the cock *D*, 2½ in. above the mud ring, had not yet become perceptibly warm to the touch. The pointers at that time showed the expansion of the plates to be as follows:	13	5¾ points.
	12	6 "
	11	6 "
	10	6¼ "
	9	6¾ "
	8	8 "
	7	7¼ "
	6	7½ "
	5	8¼ "
	4	8¼ "
	3	7¾ "
	2	2 "
	1	1 "
Expansion of outer sheet at	X 3	7 points.
	X 2	6 "
	X 1	3¾ "

TEST No. 8.	No. of plate.	Expansion on dial.
From 5.23 to 6.15, with a good coal fire on the grate, an average of six different tests gave the expansion of each plate as shown in this table.	13	8 points.
	12	7¾ "
	11	7 "
	10	7 "
	9	7½ "
	8	7½ "
	7	7¼ "
	6	7½ "
	5	7¾ "
	4	8 "
	3	8 "
	2	7 "
	1	6 "
Outer sheet at....	X 3	7¼ points.
" " "....	X 2	6¾ "
" " "....	X 1	6¼ "

water drawn from the cock, 2¼ in. below the top of the grate, had not yet become warm to the touch. (The exact temperature was not obtained, owing to the accidental breakage of the thermometer.) Test No. 8 shows that plates 2 and 1 expand to nearly the length of those situated higher up, soon after the water boils with considerable violence:

TEST No. 9.	No. of plate.	Expansion on dial.
The fire was allowed to burn out, and after standing two hours the water was run out at 8.45 p. m. and at 9.05 cold water was run in until full, and at 9.20 the pointers indicated the following on the dials:	13	0¾ point.
	12	0¾ "
	11	0 "
	10	0 "
	9	0 "
	8	0 "
	7	0 "
	6	0 "
	5	0 "
	4	0 "
	3	0 "
	2	0¾ "
	1	
Expansion of the outer sheet at	X 3	2 points.
	X 2	0 "
	X 1	0¾ "

TEST No. 10.	No. of plate.	Expansion on dial.
Standing full of cold water from May 5 to 9.50 a. m. May 7, the dials were carefully adjusted with all the pointers at 0, a fire was then started, and at 10 o'clock, just 10 minutes after starting it, the pointers indicated the expansion for the several plates to be as follows:	13	2¼ points.
	12	3½ "
	11	3¾ "
	10	4 "
	9	4¼ "
	8	4¾ "
	7	4¾ "
	6	5¾ "
	5	6¾ "
	4	7¾ "
	3	3¼ "
	2	0¾ "
	1	0¾ "
Expansion of the outer sheet at	X 3	3¼ points.
	X 2	2¾ "
	X 1	0¾ "

Test No. 9 shows that the plates contracted to their original length after cooling off and the waterspace was filled with water at a temperature of 54 degrees, except Nos. 13 and 12, which were in contact with the water that had abstracted a little heat from the plates as it came in contact with them while it gradually rose in the waterspace, as the water flowed in. Plate No. 1 was slightly affected by heat still retained in the mud ring.

Test No. 10, as in Nos. 1 and 7, shows the great changes that take place in the relative length of plates 2, 3 and 4, in the short space of 10 minutes after starting a fire; there being 7 points, or nearly ¼ of an inch, difference between the length of plates Nos. 2 and 4.

TEST No. 11.	No. of plate.	Expansion on dial.
At 10.13, or 13 minutes after test No. 10 was made, the water at the top boiled, while that drawn from the cock near the mud-ring was still cold to the touch. The pointers at this time showed the expansion of the plate to be as follows:	13	7 points.
	12	7¼ "
	11	7½ "
	10	7¾ "
	9	7¾ "
	8	7½ "
	7	7¼ "
	6	8 "
	5	8¼ "
	4	8¾ "
	3	7¾ "
	2	1¾ "
	1	0¾ "
Expansion of outer sheet at	X 3	7 points.
	X 2	6½ "
	X 1	3 "

TEST No. 12.	No. of plate.	Expansion on dial.
At 10.25, or 12 minutes after test No. 11 was made, the water drawn from the bottom of the water space was at blood heat, while that at the top was boiling and throwing off large quantities of steam. The pointers at this time indicated the expansion of the several plates to be as follows:	13	7½ points
	12	7¾ "
	11	7½ "
	10	7½ "
	9	7½ "
	8	7¾ "
	7	7½ "
	6	7¾ "
	5	8 "
	4	8¼ "
	3	7¾ "
	2	6¾ "
	1	2½ "
Expansion of outsheet at	X 3	7¼ points
	X 2	7 "
	X 1	5½ "

TEST No. 13.	No. of plate.	Expansion on dial.
After the fire had been kept up a little more than an hour after test No. 12 was made, and while steam was rapidly thrown off from the top of the boiling water, at 11.50 o'clock a. m. the pointers indicated the expansion to be as follows:	13	7½ points
	12	7¾ "
	11	8 "
	10	8 "
	9	8¼ "
	8	8 "
	7	8 "
	6	8¾ "
	5	8¾ "
	4	8¼ "
	3	7½ "
	2	6½ "
	1	
Expansion of outer sheet at	X 3	7 points.
	X 2	7 "
	X 1	7 "

TEST No. 14.	No. of plate.	Expansion on dial.
At 11.55, or 5 minutes after test No. 13, the fire was drawn from the box, and it was left to cool until 2.15, or 2 hours and 20 minutes, when the water was run out, and 5 minutes after cold water was run in, until it covered the top of Plate No. 7. The pointers then indicated the expansion for the several plates to be as follows:	13	2½ points.
	12	2 "
	11	2¼ "
	10	3¼ "
	9	3½ "
	8	3 "
	7	1 "
	6	1 "
	5	1 "
	4	1 "
	3	1 "
	2	1 "
	1	1¾ "
Expansion of the outer sheet at	X 3	3 points.
	X 2	1 "
	X 1	1¾ "

TEST No. 15.	No. of plate.	Expansion on dial.
Water was then allowed to flow in until full, and 5 minutes after test No. 14, the pointers indicated the expansion to be as follows:	13	1 point.
	12	0¾ "
	11	1½ "
	10	2 "
	9	1¾ "
	8	1¾ "
	7	0¾ "
	6	0¾ "
	5	0½ "
	4	0¾ "
	3	0½ "
	2	0¾ "
	1	0¾ "
Expansion of the outer sheet at	X 3	1 point.
	X 2	0½ "
	X 1	0¾ "

TEST No. 16.	No. of plate.	Expansion on dial.
After standing from 12 o'clock until 3.50 cold, a fire was started, and at 4.14 the water boiled violently at the top, while that drawn from the Cock *D*, at the mud ring was still cold to the touch. The fire burned briskly on the grate and the pointers indicated the expansion at that time to be as follows:	13	7¾ points.
	12	8 "
	11	9 "
	10	9¼ "
	9	9 "
	8	9 "
	7	8½ "
	6	8½ "
	5	8½ "
	4	9¼ "
	3	8 "
	2	4¾ "
	1	0½ "
Expansion of the outer sheet at	X 3	7¾ points.
	X 2	6½ "
	X 1	4½ "

Tests No. 11 and 12 show the same results as others previously made under the same circumstances—a great difference in the expansion of the lower plates. No 13 shows the expansion to be not much less in the lower than in the upper plates, after the circulation produced by the violent ebullition has been continued sometime. Test No. 14 shows the sensitiveness of the plates to a change in the temperature of the water in contact with them. After the water had been run out, and before any cold water was run in, the expansion was nearly the same in all; but as soon as it began to flow in, the plates contracted rapidly as they were, one after the other, covered by water; as shown by the difference between plates 7 and 8.

After the water was again allowed to flow in until full, the contraction was still further increased. The heat taken from the plates by the water, as it rose in the waterspaces, is shown in the upper plates in test 15. Whenever water is below the boiling point, there is no circulation, except that necessary to allow the warmest to find its way to the top, where it will remain as long as it remains warmer than that below it Test No. 16 shows the same results as to the great difference in the expansion between the plates immediately above the grate and those below it. When this test and subsequent ones were made, the water necessary to replace that evaporated was run in in a regular supply at the bottom, while in the case of previous tests it was run in at the top of the waterspace near one end. Supplying at the bottom may account for the low temperature, and consequent little expansion of plate No. 1 in this test.

TEST No. 17.	No. of plate.	Expansion on dial.
After test No. 16 was made, a good fire was kept up for 45 minutes, with no material change in the expansion of the plates, except No 1 had expanded to 6 points and No. 2 to 7¼. About 400 cub. in. of mud (clay) was then poured in at the top of the water space, which caused priming or foaming to a considerable extent, when the pointers indicated the following expansion:	13	8¼ points
	12	8½ "
	11	9 "
	10	9¾ "
	9	9¼ "
	8	9¼ "
	7	8¼ "
	6	8¼ "
	5	8¼ "
	4	9 "
	3	8½ "
	2	7½ "
	1	5½ "
Expansion of the outer sheet at	X 3	8 points.
	X 2	7 "
	X 1	6¾ "

TEST No. 18.	No. of plate.	Expansion on dial.
After test No. 17 was made, the fire was allowed to burn out and the box stood until 8.00 o'clock a. m. the next day, with the mud and muddy water in it, when it was found that the mud had settled on the mud ring to a depth of 2¼ in. The pointers then indicated the expansion to be as follows:	13	1 point.
	12	0 "
	11	0 "
	10	0 "
	9	0 "
	8	0 "
	7	0 "
	6	0¼ "
	5	0 "
	4	0 "
	3	0½ "
	2	0½ "
	1	0 "
Expansion of the outer sheet at	X 3	1 point.
	X 2	1 "
	X 1	1¼ "

TEST No. 19.	No. of plate.	Expansion on dial.
The muddy water was run out and clear water allowed to run in until full. Another pair of pointers and dials was attached to the bottom of the outer sheet, in line with the centre of the rivets in the mud ring, and designated as X0, corresponding in height with those of plate No. 1. A fire was started at 2.03 p. m., and at 2.23 the pointers indicated the expansion of the plates to be as follows:	13	4½ points
	12	6 "
	11	6¾ "
	10	7¾ "
	9	7 "
	8	6¾ "
	7	6¾ "
	6	7½ "
	5	7 "
	4	7½ "
	3	6 "
	2	1 "
	1	0 "
Expansion of the outer sheet at	X 3	5¾ points
	X 2	5½ "
	X 1	1¾ "
	X 0	0½ "

TEST No. 20.	No. of plate.	Expansion on dial.
At 2.30, or 7 minutes after test No. 19 was made, the water boiled at the top while cold water was slowly flowing in at the cock *D* at the bottom, in quantity sufficient to replace that thrown off by evaporation. At this time the pointers indicated the expansion of the several plates to be as follows:	13	7½ points
	12	7¾ "
	11	8½ "
	10	8½ "
	9	7¾ "
	8	8½ "
	7	7¾ "
	6	8½ "
	5	8½ "
	4	7¾ "
	3	7½ "
	2	5 "
	1	0 "
Expansion of the outer sheet at	X 3	6¾ points
	X 2	6¾ "
	X 1	3¾ "
	X 0	1¾ "

The introduction of mud (clay) in test No. 17 produced but little effect on the expansion of the plates, being nearly the same as test No. 16. The top of waterspace being open to the air at two points, more or less water was thrown out with the steam, necessitating the introduction of a greater quantity of cold water in a given time than in previous tests, may have slightly effected some of the lower plates. Plate No. 13, being partly above the top of the fire-box, and also partly above the water, does not always correctly indicate the temperature of the water at that point, as the part above the water was affected more or less by the atmosphere, except when the steam and water thrown up by the ebullition excluded the air from it. In this test, foaming caused the water to cover about the whole of the plate. Test No. 18 shows that, when cold, the plates had contracted to their original length, except plates 2 and 3, which showed 0¼ point less than the original length, and plate No. 6, 0¼ more. Plate No. 13 at that time was above the surface of the water, and was affected by the atmosphere to the extent of 1 point.

Test No. 19 gives the same results as previous one, made under similar circumstances, the expansion of the outer sheet being a little more, at the top and bottom, than the plates composing the inner sheet, while at the centre in its height expansion is a little less.

Test No. 20 shows the effect of the cold feed-water, as it flowed in at a point 2½ inches below the top of the grade, in keeping down the temperature of plate No. 1, so that at 27 minutes after the fire had been started, and while plate 3 had expanded 7¼ points, and plate 2 5 points, No. 1 shows no elongation. The expansion of the outer sheet (which was all in one piece) gives results similar to that in test No. 19. At X 0, (at the line of rivets in the mud ring) the expansion was 1¼ points, while that of plate No. 1 (at the same point) was 0. At X 1 the expansion of the outer sheet (corresponding in height with plate No. 2) was 3¼ points, while that of plate No. 2 was five points. At X 2 (corresponding with plate No. 6) the expansion was 6¾ points, while that of plate No. 6 was 8¼ points. At X 3 (corresponding in height with plate No. 11) the expansion was 6¾ points, and that of plate No. 11 was 8¼ points. The results of expansion, as shown in the outer sheet, indicate that the lower edge of that sheet was elongated the 1¾ points, not from temperature, but from being attached to a part of the sheet above it, where the temperature was greater. At X 1 the expansion was not as great as that due to temperature, being but 3¼ points, while that of plate No. 2, (the same in height) free to assume a length due to temperature, was 5 points, showing that the sheet through X 1 was partially held back from assuming its proper length by the part through X 0, and that by reason of the steam brought upon X 0, by holding back X 1 from a length due to its temperature, X 0 was elongated 1¼ points more than that due to its temperature.

TEST No. 21.	No. of plate.	Expansion on dial.
At 2.47, or 17 minutes after test No. 20 was made, the feed-water flowing in at the cock *D* in a regular quantity to supply that carried off by evaporation, the pointers indicated the expansion to be as follows:	13	7½ points.
	12	8 "
	11	7¾ "
	10	8½ "
	9	8¼ "
	8	8¼ "
	7	7¾ "
	6	7¾ "
	5	8¼ "
	4	8¼ "
	3	8 "
	2	6¼ "
	1	1 "
Expansion of the outer sheet at	X 3	7 points.
	X 2	6¾ "
	X 1	4 "
	X 0	2½ "

TEST No. 22.	No. of plate.	Expansion on dial.
At 3.40 the fire was allowed to burn out, and after standing until 6 o'clock the pointers indicated the expansion to be as follows, the water at that time being as high as the top of plate No 11; plates 12 and 13 were exposed to the air on both sides:	13	1½ points.
	12	2¾ "
	11	4 "
	10	4¼ "
	9	4½ "
	8	4½ "
	7	3½ "
	6	3¼ "
	5	3 "
	4	2¾ "
	3	2¾ "
	2	2¾ "
	1	2 "
Expansion of the outer sheet at	X 3	2 points.
	X 2	2 "
	X 1	1½ "
	X 0	1½ "

TEST No. 23.	No. of plate.	Expansion on dial.
After cooling until 8.00 o'clock, or two hours after test No. 22 was made, the pointers indicated the expansion of the plates to be as follows. The water at this time covered the top of plate No. 11:	13	0¼ point.
	12	1 "
	11	2½ "
	10	2½ "
	9	1¾ "
	8	2 "
	7	1½ "
	6	1½ "
	5	1½ "
	4	1½ "
	3	1½ "
	2	1¼ "
	1	0¾ "
Expansion of the outer sheet at	X 3	2 points.
	X 2	1¼ "
	X 1	0¾ "
	X 0	0¼ "

TEST No. 24.	No. of plate.	Expansion on dial.
After standing from 8 o'clock p. m. of the 8th until 9 a. m. of the 9th, the pointers indicated the expansion to be as follows, the water covering the top of plate No. 10. The sun had been shining on the fire-box for two hours, but not directly on these plates:	13	1 point.
	12	1¼ "
	11	1½ "
	10	1¾ "
	9	1¾ "
	8	1¾ "
	7	1 "
	6	0¾ "
	5	0¾ "
	4	0½ "
	3	0¼ "
	2	0¼ "
	1	0¼ "
Expansion of the outer sheet, which was shaded from the sun, was as follows at	X 3	0 point.
	X 2	0 "
	X 1	0 "
	X 0	0 "

As previously stated, in all the tests with this waterspace, given above, the top was open, permitting the escape of the steam as fast as generated, without pressure, so that no greater temperature of the water, at the hottest place, was obtained, than 212 degrees. The results show conclusively that with a solid or single sheet, situated as the one composed of a number of plates, the strains developed in the lower part of it, represented by plates 1, 2, 3, and 4, must at times be very great, owing to difference of temperature and consequent expansion.

If we take the results as shown in test No. 19, and apply them to a large sheet in one piece, we find that the parts represented by plates 3 and 4 will be under a strain of compression, for the reason that that part can not assume a length due to its temperature, because connected to the cooler and shorter part of the sheet represented by plates 1 and 2; and as that represented by plate No 1 is riveted to the mud ring, the forces of the part above it (plates 3 and 4) would not be sufficient to elongate the mud ring, but the parts represented by plates 3 and 4 would be permanently shortened by reason of this compression, whenever it should assume proportions above the elastic limit of the metal; and then, when the sheet in all its parts should become the same in temperature, this part, permanently shortened, would be under a tensile strain.

The proportions of exwansion given in the tables above are for a length of sheet exposed to the action of the fire, and also of the water, of 44 in. Now if this length was increased to that of an ordinary fire-box for a locomotive, say to 66 in., the expansion would increase, in the aggregate, to the same extent—one third°; and if we assume that the expansion for each degree of heat above 212° is the same as that below it, until a temperature of 350 degrees is attained (equal at the hottest part to that due to a steam pressure of 130 lbs. per inch), the expansion would be still further increased by reason of increased temperature, about 85 per cent. If we take test No. 17 as a basis and add one-third to that given for each plate for increased length of plate, and 85 per cent. more for an increase of temperature, then the result would be that due to a length of plate of 66 in., and a steam pressure of 130 lbs. at the hottest part; and as represented in the following table, No. 25. Test No. 17 was made after the water had been boiling an hour or more, and when the lower plates were as hot as they could be made while the feed water was flowing in.

In the case of a side sheet in a fire-box of a locomotive the

expansion would not, perhaps, entirely coincide with that shown in the various tests, even if the sheet was made up of a series of plates free to assume a length due to temperature, for the reason that after starting a fire when the boiler is full of cold water, a great amount of heat is carried up to heat the water above the crown sheet, and above the top of the water-space, before the water in the lower part of the latter increases

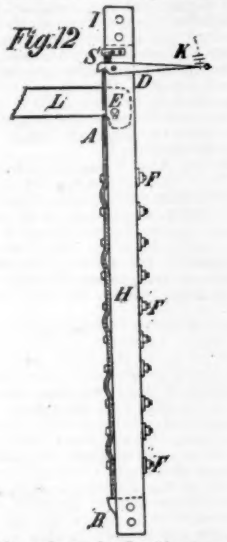
TABLE No. 25.

No. of Plate.	Expansion on Dial.	No. of Plate.	Expansion on Dial.
13	21 points.	4	22 points.
12	21 "	3	21 "
11	22 "	2	18½ "
10	24 "	1	13½ "
9	22¾ "		
8	22¾ "	X3	19¼ points.
7	21 "	X2	17 "
6	21 "	X1	16½ "
5	20½ "		

much in temperature, and as the heat is at first greatest at the top of the water, and heats downward, so to speak, this line of greatest difference of expansion between two parts of the sheet will be carried higher up than the position of plate No. 3, Fig. 8, until after circulation, induced by boiling, causes currents of hot water to extend downward to bottom.

With a strong draft and a very hot fire on the grate, and a large quantity of steam drawn from the boiler in a given time, it is probable the expansion would vary somewhat from that given in table No. 25: it would be greatest in the plates nearest the fire, and less in those below the top of the grate; the latter, on account of the large quantity of cold water required to supply that carried off as steam, and the current of cold air brought in contact with those plates by the draft.

Elasticity in the metal of the sheet is absolutely necessary in order to prevent injury from the forces developed by expansion. This it has to a certain extent, in a plain straight sheet, but if the requirement is such that the limit of elasticity may be exceeded, then it would seem that a change of the form of the sheet should be made at such point, curving it, for instance, as to allow the spring of the curves to give a part of the elasticity required. In order to test the effect of curves or channels in giving elasticity to a sheet in the direction of its length, a plate of steel 50 in. long, 3¾ in. wide and $\frac{5}{16}$ in. thick taken from the same lot as those composing the sheet shown n fig. 8, had five channels or curves, in a transverse direction,



pressed in it, cold, as shown in fig. 11, at a distance of 9 in. between centres, the depth of the channels being $\frac{5}{16}$ in., the thickness of plate and length of curve 3 in. Staybolt holes were placed along the centre of the plate, 4½ in. between centres.

To ascertain to what extent these transverse channels would permit the plate to be shortened by compression on the ends without permanent set or shortening, and what force was required to produce the different degrees of such shortening before permanent change in its length took place, it was fixed on the edge of two bars of 4×1 in. iron, bolted together, leaving a space of 1⅛ in. between, as represented in fig. 12. *H* represents the two bars of 4×1 in. iron, bolted together at *L* and *B*, with distance pieces between them, *F*, *F*, *F*, holding it in its place on the edge of the bar *H*.

One end of the plate rested on a step at *B*, the other terminating at *A*. *L* represents the lever upon which weights were hung to produce the required compression; a knife-edged pin passing through the end of the lever at E, a knife-edged bearing piece filling the space from the end of the plate at *A* to the lever *L*.

D represents a pointer 12 in. long from its centre to the point, and attached to the end of the plate at *A* by a wire, held in place by a coiled spring *S*. *K* represents the dial, graduated to 12 parts to the inch, so that compression of the end of the plate in the direction of *B* sufficient to cause the pointer to move one point on the dial would indicate that the plate had been shortened the one hundred and fourty-fourth part of an inch, the same as in the case of the pointers and dials used to measure the expansion of the plates composing the sheet of the fire-box, one point meaning the same in both cases; the plates also being of the same length.

The bolts *F*, *F*, *F* were tightened sufficiently to keep the plate to a bearing on the bars *H*, but not so as to interfere with its free movement in the direction of *A* or *B*. After a few tests were made, so as to bring all the working parts to a perfect bearing, the lever was loaded, causing the pointer to move upward on the dial *K*, and the plate to be shortened in the direction of *B*, with the different loads applied to the end of the plate, as follows, shown in Table 26.

TABLE 26.

Weight on the end of plate.	Distance the pointer moved on dial.	Weight on the end of pate.	Distance the pointer moved on dial.
2,950 lbs.	1 point.	15,350 lbs.	7 points.
5,100 "	2 "	17,000 "	8 "
6,900 "	3 "	Began to loose elasticity.	
9,200 "	4 "		
11,250 "	5 "	17,700 lbs.	9 "
13,450 "	6 "	18,600 "	10 "

The load was applied and removed in each case, the pointer returning to its original position, until over 17,000 lbs. had been applied, when it was found that the pointer did not return quite to 0; and after 138600 lbs. had been applied and removed, it did not return to its original position by 1½ points, showing that the plate had been permanently shortened to that extent (about the $\frac{1}{64}$ of an inch). The sectional area of the plate was 1.17 in., and with a force of 17,000 lbs. resting on the end at *A*, in the direction of *B*, the depth of the channels was increased to $\frac{3}{64}$ of an inch, or $\frac{1}{32}$ of an inch more than when free from strain by the spring of the curve outward. All seemed to spring about alike, as near as could be measured, and on removal of the load returned to their original proportions. The same forces applied in the opposite direction would doubtless produce elongation to the same extent.

Several other tests were made, similar to that given above, but all were so near alike in their results that to give any more seems unnecessary. The results of the various tests given above are submitted and made a part of the report of the committee on "the Best Material, Form and Proportions of Locomotive Boilers and Fire-boxes," by the Chairman of your committee, believing that they fully confirm the views heretofore expressed by himself and other members of the committee as to the causes that in time so often result in injury to the sheets of the fire-box at points not far above the top of the grate, either in leakage at stay-bolts, small cracks, or in a vertical rupture of the sheet.

The remedy for what is on most roads a source of much trouble and expense—crack in fire-box sheet—will most likely be found in some form of corrugation, or channels, in that part of the sheet vertical in direction. The best form of such corrugations is yet to be determined. The vertical channel between the rows of stay-bolts will answer the purpose, if the spring of the curve at the point where it leaves the straight part of the sheet does not in time produce a "seam" on the water side, and which in time might end in a crack. The greater the number of corrugations, the less will be the spring required of each one, consequently the less danger of resulting in cracks from the uncqual expansion in different parts of the sheet.

MASTER CAR BUILDERS' ASSOCIATION.

Eleventh Annual Convention.

[Continued from page 289.]

At the evening session of the first day the first business taken up was the motion to amend the constitution by adding to Section 4, Article 3, the words "Three years in arrears for dues."

Mr. SMITH moved to amend by adding: "All members who are two years or more in arrears for annual dues shall have no voice in the meetings until such arrears are paid."

The amendment was accepted and the motion, as amended, carried.

An invitation from the Fire Commissioners of St. Louis was declined with thanks, the hour named being unsuitable.

The discussion on the substitution of steel for iron and iron for wood was then resumed.

Mr. FORD thought that the question of using larger wheels, which had also been discussed in the morning, was intimately connected with this. It would be difficult to make a 42-in. wheel as strong as a 30-in. wheel, unless the best iron was used and great care taken in the manufacture.

Mr. HOPKINS said that one thing in favor of the large wheel was that it would, by giving increased leverage, diminish very much the friction at the journal and the slipping of car wheels.

Mr. ADAMS thought that large car wheels were not the subject under discussion.

Mr. FORD said that the subjects were intimately connected. He thought that if the large wheels were to be generally used they would have to use steel-tired wheels in place of the cast-iron chilled wheel.

Mr. SMITH said that some present had been using 42-in. cast iron wheels, and asked for their experience.

Mr. ADAMS said that few of them had had much experience in the use of iron and steel. He was very much in favor of using iron bolsters instead of wood, and also of steel-tired wheels in place of iron. As to steel it was still uncertain how much dependence could be put on it, and he thought no very positive opinion could be expressed as yet. He thought most of them would prefer iron trucks to wooden ones. In answer to a question, he said that he had not the exact figures, but thought an iron bolster would be a little heavier than a wooden one. He had never seen a wooden bolster that would not spring.

The PRESIDENT asked if any one had had experience with iron cars.

Mr. FORNEY said that the Baltimore & Ohio had used iron coal cars for 20 years. When they were first adopted wood was much cheaper and iron higher than now, and if they were economical under these circumstances the matter was worth looking into.

Mr. FORD said that a road in Ohio had built some cars on drawings obtained from the Baltimore & Ohio, but had found them too weak in the frame. Connecting roads had refused to receive them, because they were liable to break down.

Mr. FORNEY said that the Baltimore & Ohio had hundreds of those cars in use on a very difficult road, and any such weakness must have been detected years ago. Twenty years' use was pretty strong evidence.

Mr. AYLESBURY said that the Reading road had used iron coal cars for 23 years but had abandoned them because they were too expensive to keep up.

Mr. FORNEY said the Baltimore & Ohio was still building them a year ago.

Mr. SMITH said that these Baltimore & Ohio cars weighed 13,000 lbs. and carried 10 tons. They have been used 20 years and he saw no reason why they should not do well elsewhere, unless it was that every road was determined to have a standard of its own.

Mr. AYLESBURY said that the Reading had used them.

Mr. COULTER said some of them had been run on his road. Shippers objected to them for grain, because the grain was liable to sweat.

Mr. FORNEY said they had been used for grain only in an emergency, when the road was short of cars. He did not indorse the cars; only called attention to them as they had run so long.

Mr. HOPKINS thought that many present could contribute valuable notes from their experience, if they would only speak.

Mr. KIRBY was not opposed to iron cars. They had built two of them six or seven years ago, which carried 20 tons.

Mr. HOPKINS said that they could afford to pay $1,200 for iron cars carrying 20 tons, if they could not get wooden cars to do the same work.

Mr. KIRBY thought that almost any car-builder present could build a wooden car to carry 20 tons for $500 or $600.

Mr. ADAMS thought it would be well to distribute the weight more, to get more bearings from the timbers, for instance, by making a double bolster of ⊤ iron. He had no doubt that an iron bolster could be made lighter than wood and very much stronger.

Mr. AYLESBURY said that the great objection to a wooden bolster was that the drawhead timbers butted up against it, not running through. He used an iron bolster, the top bar ¾ in., the bottom one ⅞ in. iron. He thought that an objection to making transoms of ⊤ iron would be that you must butt the draw timbers against it or cut the iron away. The great benefit of iron transoms was that you could run the draw timbers through. The iron transoms he used weighed 260 lbs. each, 525 lbs. for the car.

Mr. KIRBY asked if the draw-timbers running through were all the support he gave to the transom, and if he used any distance pieces.

Mr. AYLESBURY said that he used thimbles through which the bolts ran.

Mr. KIRBY said that on his iron cars the frame was constructed just as if it was to be covered with wood, but was covered with iron outside and with boards inside. He noticed some of these cars a short time ago. The iron was corroding quite fast, and underneath the bottom where it had been covered with sheet iron to prevent sparks from alighting on the wood, the sheet iron was rotten as a piece of burnt paper. That was his experience where wood and iron came in contact, but the wood will outlast the iron.

The PRESIDENT said he was not a strong advocate of the kind of iron cars he had seen. They had some on the New York Central which gave them a good deal of trouble, especially the draw-bar attachments and brake-rigging. He did not know how long they had been in use, exactly, but it was from 15 to 18 years. He had had a set of trucks made of steel, the reduction in weight of the frame being about one-third. These had been tested quite severely, loading the car with 16 tons, and they had sprung more than the regular iron trucks. He had nearly finished a set of combination trucks, iron and steel, to go under a car 34 ft. long and carrying 15 tons. He thought there was no question that it was best to use iron or steel for the bolster. The question of iron or steel wheels would come in there, if they had any data to go upon, and it might be well to appoint a committee to get information.

Mr. L. GARVEY said grain could not be shipped in iron cars as at present made.

Mr. ORTTON thought that the subject should be continued for a year, to get more information. He asked if Mr. Chamberlain could give the data he had spoken of on steel and iron axles.

Mr. CHAMBERLAIN said he had inadvertently left at Allston a document embodying three years' experience, but he had some documents with him.

He then exhibited some sketches showing the quality of material of steel and iron axles, which had been etched 2½ hours in chemically pure muriatic acid, and also some samples of links and pins before etching and afterwards.

He said the pieces were cut off ¾ in. long. The printing was done by simply rubbing a roller saturated with ink along the plate and then putting it under a common letter press. The etching process was simply to take pure muriatic acid, dilute it with water and put the specimens of iron or steel into it, letting them remain 2¼ hours. To test the tensile strength he drilled a core right out and tested it in a machine. Some time ago they had had trouble with hot journals. He had tried everything and had packed journals himself to be sure they were right, but still they heated. At last he tried a microscopic examination and found little fibres of iron sticking up like knife-blades on the journal.

A motion was then made and carried that Mr. Chamberlain be requested to furnish the documents he had left behind, and that they be entered on the minutes.

Mr. ADAMS suggested that the committee be continued, with an addition to its numbers.

Mr. ORTTON thought it better to continue the committee simply. This discussion had drawn attention to the subject and would make members ready to study it up and to give the results of their observation.

A motion to continue the committee was then carried.

Mr. FORNEY moved that the committee be instructed to consider the question of wheels also and to suggest some system of keeping wheel mileage. He spoke of the difficulty of getting exact information about wheels and the causes of their failure

Mr. CHAMBERLAIN referred to the discussions on this subject at the monthly meetings and said wheel-makers were ready enough to guarantee their wheels, but did not say how they did it. The individual mileage was needed.

Mr. SMITH thought it better to have a separate committee on wheels, and Mr. FORNEY accepted the amendment.

Mr. ORTTON did not think it was possible to keep mileage of freight cars, until some general plan was arranged. Some regard must be had to mileage of wheels flattened by sliding.

Mr. FORNEY said he knew the trouble of keeping mileage of freight cars. Many roads kept mileage of passenger cars, but the trouble was their systems were different and the results could not be compared. What was needed was a uniform system of keeping mileage. With regard to wheels sliding he had a statement from one road that 49 per cent of their wheels were lost that way.

Mr. ADAMS thought a separate committee on wheels was better.

Mr. J. B. HILL had served on the committee, and was willing to serve again, but hoped members would take more trouble to answer circulars.

The PRESIDENT suggested that the matter be referred to the Committee on Subjects.

Mr. ORTTON thought it impossible to keep freight car mileage. Their cars went all over the country, and they knew nothing about the distance they traveled while they were gone.

Mr. FORNEY said that some large roads were doing it, for instance the Pennsylvania, the Chicago, Burlington & Quincy and the Central Pacific. The difficulty was that they used different systems. The reports should all have the same headings and be made out in the same way. Of course they could not enforce a system, they could only recommend it.

Mr. ADAMS thought the preparation of the blanks proposed could be left to the Secretary and one other member.

Mr. COULTER thought the adoption of a system of reporting wheel mileage would give them just the information they needed.

Mr. AYLESBURY said they had a system of recording each wheel, the car under which it was put and the cause for which it was taken out. They got the passenger mileage exactly, but the freight mileage only approximately. They had a record in this way of the service of each wheel and the cause of its failure.

Mr. ADAMS said there were flat spots made by sliding the wheels and flat spots made by defects in the chill, and the two should not be confounded.

Mr. FORNEY said, to illustrate the importance of the subject, that he had a letter stating that on one road where they had kept an account and made an examination into causes, they had saved over $6,000 a year by reducing the number of wheels made flat by sliding.

Mr. ORTTON said that the record would be of value, but not equally; on some lines much more than others. On a crooked line, for instance, the flange-wear would be greater; on a level line there would be less sliding of wheels. It was well for a master car builder to have the figures for his own line, but others were not of much use to him.

Mr. FORNEY said that it was very important to know the actual facts, and to study them out and make comparisons.

Mr. ORTTON thought that the comparisons were not of much use, if a man had the figures for his own road. A general system was not necessary.

Mr. SUTHERLAND thought it well to have the information and it would do no harm to have a system.

Mr. ADAMS said that on the Boston & Albany they lost about 9 per cent. of the wheels by sliding in five months.

The whole matter was then referred to the Committee on Subjects.

Mr. DAVENPORT, for that committee, requested that members desiring to make any suggestions would do so as early as possible.

The Convention then adjourned until the next morning.

SECOND DAY'S SESSION.

After the convention had assembled, the PRESIDENT stated that the first business in order was the report of the Committee on Inspection and Small Repairs of Freight Cars.

Mr. FORD stated that he was the only member of the committee present, and that no report was ready. He said the question was one of much importance, especially on roads receiving many foreign cars, and invited discussion.

Mr. DAVENPORT referred to an arrangement made by Mr. Kirby for holding the heads of the drawbolts by a washer fastened in the flooring, so as to get the strength of the flooring and prevent the common trouble caused by the bolts working loose.

Mr. AYLESBURY said that he used the same thing. It was a socket-washer made the thickness of the flooring, say 1¼ in., and countersunk for the bolt-head. The floor was cut out for the washer. It was very convenient in repairing the car, in putting in new draw timbers. Instead of tearing up the floor to get at the bolts, you had only to drive the bolts out. The washers held the head fast, and prevented the bolt from turning or working loose.

Mr. COULTER had used the same thing and thought it very good. He did not make his washers quite so heavy as those spoken of.

Mr. SUTHERLAND asked if any one had tried any method of bolting the spring-timbers so that the bolt could be taken out without going inside of the car. He had heard of using a deep spring-timber butted against the end-sill and the transom and bolted horizontally to the sills. This would make it necessary to put the centre sills further apart, but the bolts could be got out without going inside the car.

Mr. CHAMBERLAIN said that such an arrangement had been made on 200 cars built for the Erie nine years ago. He thought it was very expensive and required much repair.

Mr. KIRBY then, with the aid of the blackboard, explained a plan he had seen for holding the draw-timbers without bolts. Two one-inch truss rods are used; two plates of iron, say 2½ by ⅞ in. are laid across the top of the two middle floor timbers. These project on each side far enough for the two truss rods to rest on; the ends of these rods extend to each end of the draw-timbers and pass through an iron plate 3 by 7 in. at each end. These plates are cut into the draw-timbers on the angle of the truss and extend each side far enough to receive the ends of the rods, which have a nut on each end; by screwing up these nuts the draw-timbers are held in place. Bolts are used through the deadwoods and draw-timbers. Cast iron blocks are also used, notched in between the draw-timbers and the floor-timbers.

Mr. MCILWAIN said he had seen some of these cars and thought that if they were not closely watched the timbers would slip out of place.

Mr. KNAPP said that in the car described there were cast-iron space blocks. There were no bolts or rods except those shown.

The PRESIDENT then spoke of the great difficultics encountered on through lines which had many foreign cars passing over them. The numberless patterns of cars obliged them to carry a great stock of materials for repairs and the standards of inspection were so different that cars which would pass on one road were sent back by another, making a great deal of trouble. He thought that inspectors should be provided with cards to put on cars that were not in first-class order. He referred to the rules adopted last winter by the representatives of the trunk lines and advised their adoption by the convention.

Pending a resolution to adopt these rules it was resolved that each rule be read separately and discussed.

The first rule was then read as follows:

1. All cars delivered to connecting lines must be in good running order, with journal boxes and bearings in good condition; wheels sound, free from flat spots exceeding two inches in length or diameter, or flanges with flat vertical surface extending more than ⅞ in. from tread of wheel, or less than one inch thick; axle journals not less than 2¾ inches in diameter, and brakes and draw-bar attachments in efficient condition. Each company to give foreign cars upon its line the same care and attention given its own.

The PRESIDENT said that the flat vertical surface of flanges was to be measured from the tread of the wheel. He understood also that if wheels have to be replaced and the journals are less than 2¾ in. then a new axle must be put in. With regard to the attention paid foreign cars, he had heard of cars being run off to avoid repairing them. Some roads declined to receive cars except at the same point they delivered them, but it was not always possible to return a car by the route by which it came, especially on a long road with many connections.

Mr. HACKETT said that the Pennsylvania required cars to be returned at the point where they were delivered.

The second rule was then read:

2. Wheels and axles used to replace those broken under fair usage will be charged to the company owning the car. Closely connecting lines, may, however, furnish wheels or axles to replace those broken under their cars, when giving notice previously of such choice, and paying freight and duty to destination, on wheels or axles furnished and scrap returned. Second-hand wheels may be used (without charge except for labor of refitting) to replace wheels removed from other causes than breaking.

Mr. KNAPP asked if that referred to wheels damaged, but not unsafe?

The PRESIDENT said that the wheel should pass if it was not unsafe.

Mr. AYLESBURY thought that a wheel chipped in the tread might be caused by a broken frog, and that would not be fair usage.

The PRESIDENT said that it must be presumed that a road was in fair order; the roads own cars were run over the frogs, and the risk was the same as for a foreign car.

The third rule was then read:

3. Prices for wheels and axles to be as follows: One new 33-in. narrow-tread wheel (less old) fitted on same axle, $10; one broad-tread wheel (less old) fitted on same axle, $11; two new 33-in. narrow-tread wheels (less old) fitted on same axle, $18; two broad-tread wheels (less old) fitted on same axle, $20; one new axle turned and fitted (less old), $8.

Loose wheels may be refitted on second-hand axles, and charged $2 per wheel, or per pair. No charge to be made for the axle, and all shop marks on such wheels and axles must be reported upon the bill to the road owning the car. Prick-punching the wheel seat of axle, or shimming the wheel, shall not be allowed.

On this there was a little discussion, in the course of which it was explained that where one wheel was broken and the other could not be matched, so that two new wheels had to be put on, only one wheel could be charged for, the second wheel taken off being good.

The fourth rule was:

4. One railroad company rendering bill against another for wheels and axles *shall note on bill* the manufacturer's name and date found on such wheels or axles removed, together with the railroad company's marks, with the number, class and line of cars from under which they were taken, and date of removal.

Mr. COULTER hoped this rule would be enforced. He frequently had bills for repairs sent in such shape that he could tell nothing about them.

The fifth rule was:

5. When cars or parts of cars are repaired or replaced by companies not owning the same, the standard form and material used in the original construction must be followed in detail. Any company departing from this rule shall be liable for the cost of changing the same again to its standard, proper credit to be given for material removed.

The PRESIDENT explained that there had been a great deal of trouble in this matter.

Mr. COULTER had had so much trouble that he found the only way to stop it was to retaliate.

The sixth rule was:

6. Cars must be returned to connecting lines in as good general condition as when received, and each company must bear the expense of running repairs and damages to all cars while upon its line.

The seventh rule as read was:

7. Car inspectors at terminal or junction stations, and agents at junctions where there are no inspectors, must promptly inspect on arrival all cars offered for interchange, and make a record of the defects of cars not in good order, and decline receiving them until the needed repairs are made; provided, however, if a car be loaded and in good running order, it may be forwarded, if the company delivering agrees to receive it back in like condition, or will order the repairs made and charged to them by the receiving company.

Mr. MCILWAIN asked if he received a car in defective condition as provided and it broke down entirely, must he repair it?

The PRESIDENT said they had frequently been caught that way and the only way was to repair the car and say no more. It was certainly running a risk to take it.

The eighth rule was as follows:

8. When cars are destroyed on foreign roads, the owners must be notified immediately, that a settlement may be speedily effected; in settling, it shall be optional with the company destroying whether it will rebuild the car or pay the cost of replacing it, less 6 per cent. per annum upon the yearly depreciated value of the parts destroyed, since last built. In case of disagreement on any point not covered by this rule, each company shall appoint an arbitrator, with power to select a third party, to decide the point of difference, or fix upon the value of the betterments to the car, in case of rebuilding.

Mr. ORTTON thought that the percentage should not be so great when the car was new as when it was half worn out. A car ten or twelve years old would certainly depreciate faster than a new one. Again, this rule might work badly by a company building a new car for another and charging a considerable amount for depreciation, when the old one was good for all practical purposes.

Mr. STEWART thought some time should be specified to notify the owner of a car or to return it.

Mr. GAREY said that was covered by the last clause. His practice was not to rebuild a car but to pay for it.

Mr. ORTTON thought that if a car was rebuilt no charge should be made for betterments unless the old one was rotten. For himself he did not believe in arbitration. As to the depreciation allowance he had made a little calculation and found that by the twelfth year a car costing $500 when new would be only valued at $230, and a time would come when it would be worth nothing at all.

Mr. KIRBY thought that Mr. Ortton had misunderstood the rule. He had studied this question of depreciation and thought the rule was not out of the way.

Mr. ORTTON thought the allowance was too small. When a car was ruined the old material was worth $200. The scale ought to be inverted.

The PRESIDENT thought that a car would depreciate as much the first year as the second. The arbitration clause was put in to cover objections that might be raised.

The next three rules were then read:

9. In case the delivering and receiving inspectors disagree as to the condition of a car, the case is to be immediately referred to the superintendents or their representatives.

10. When one railway company repairs cars for another (as per Rule 7), material shall be charged at cost, and 15 per cent. added to the net cost of the labor.

11. Sills broken or materially injured must be replaced by new ones of the same size and of good quality, an exception to be made of intermediate and outside sills to which the draw timbers are not attached, which, if broken between bolster and end sill only, may be spliced with a "ship splice" of not less than 24 inches in length and secured by three five-eighth inch bolts, all in a workmanlike manner.

Mr. ADAMS asked what was meant by "materially injured?"

Mr. FORD thought that work done for another road should be charged at actual cost, instead of fixing arbitrary prices.

The PRESIDENT said it was thought best to fix arbitrary prices on account of the great number of companies and the difficulty of settling on so many different scales.

Mr. ADAMS said that practical use had developed some objections to these rules and the indefiniteness of this term "materially injured" was one of them.

Mr. GAREY said that if an intermediate sill was broken between the bolster and end sill, it needed splicing.

Mr. ADAMS said a timber might appear sound and strong, but be cracked from some concussion.

Mr. KNAPP mentioned a case where a timber broken on one side might be made sound without splicing.

The remaining three rules were then read:

12. Iron castings (interchanged) shall be charged 3½ cents per pound; journal bearings 32 cents per pound.

13. These rules shall take effect from and after Jan. 1, 1877.

14. Upon an application to the Chairman, in writing, of seven railway companies, parties to this agreement, it shall be the duty of the Chairman to call another meeting for revision of the rules, the articles to be revised to be stated in the call.

The resolution that all the rules be adopted by the Association as they stood was then passed unanimously.

History of the Chicago, Rock Island & Pacific Railroad Company.

The following interesting sketch of this company prefaces the last annual report:

The directors, recognizing the fact that the stockholders of this company have changed and largely increased in number during the last few years, deem it proper to sketch, briefly, a history of the formation of the company, and the means by which it obtained control of the various lines of road now owned, leased or operated by it, for the information of those who have more recently become shareholders.

The Chicago & Rock Island Railroad Company was incorporated by special charter, granted by the legislature of Illinois, in 1851. Its main line was completed in 1854, from the city of Chicago to the city of Rock Island, on the Mississippi river, a distance of 181⅓ miles.

In 1852, the Mississippi & Missouri Railroad Company was incorporated in Iowa, with power to build and operate a railroad from the eastern line of the State at Davenport, by way of Des Moines, to Council Bluffs, on the Missouri River.

In 1853, "The Railroad Bridge Company" was incorporated by the legislature of Illinois, with power to erect, maintain and operate a railroad bridge over that portion of the Mississippi river within the jurisdiction of Illinois at Rock Island. The Mississippi & Missouri Railroad Company had power under its articles of association and the general laws of the State of Iowa, to erect a bridge from the middle of the main channel of that river to the Iowa shore. The two companies entered into an agreement for the construction of a bridge extending from the Island of Rock Island to the Iowa shore. In 1854, this arrangement was superseded by a tripartite agreement, between the Railroad Bridge Company, the Mississippi & Missouri Railroad Company, and the Chicago & Rock Island Railroad Company, for the construction of the bridge for the use of the railroad companies, with the proceeds of bonds, to the amount of three hundred thousand dollars, to be issued by the bridge company, secured by a mortgage upon its property, and the payment of which was also guaranteed by the railroad companies. A guaranty was indorsed by each company upon the bonds, with an agreement that each should pay one-half of the principal and interest of the bonds; that a failure, by either, to make such payment, and a performance of the entire contract by the other, as to principal or interest thereafter maturing, should entitle the party thus performing to the exclusive control and use of the bridge. This was the first attempt to erect a bridge across the Mississippi River; the expenses of construction were enormous, and were greatly augmented by the determined opposition which the enterprise encountered, in the form of litigation to enforce its removal, actions for damages alleged to have been caused to boats in passing the structure and attempts to destroy it by burning. It was soon found that the moneys provided would not be sufficient to defray the expenses necessarily incurred, and additional bonds to the amount of one hundred thousand dollars were issued, under the tripartite agreement, and secured by the mortgage and guaranty above mentioned. The Mississippi & Missouri Railroad Company soon became embarrassed, and failed to perform its part of the guaranty. Thereafter, the interest and principle of these bonds were paid by the Chicago and Rock Island Company and its successor.

In 1866, the mortgages executed by the Mississippi & Missouri Railroad Company, to secure the payment of moneys borrowed and expended in construction, were foreclosed, and its property purchased by the Chicago, Rock Island & Pacific Railroad Company of Iowa, a corporation organized in the interest of the Chicago & Rock Island Railroad Company. On the 20th of August, in that year, a consolidation was effected between the Illinois and Iowa companies, under the name of the Chicago, Rock Island & Pacific Railroad Company, by which the properties, rights and franchises of both corporations were united. At that time the main line in Iowa extended from the city of Davenport to Kellogg Station, forty miles east of the State capital, and distant from Davenport 130 miles. The branch known as the "Oskaloosa Branch" extended from Wilton Junction, by way of Muscatine, to Washington, the county seat of Washington County, in the State of Iowa, and was fifty miles in length. In 1867-8-9, the main line was extended from Kellogg Station, by way of Des Moines, to Council Bluffs, on the Missouri River, a further distance of 180 miles, the entire main line being opened for traffic in June, 1869.

In 1868 the Secretary of War was authorized by an act of Congress to construct a new iron bridge over the Mississippi River at Rock Island, and to grant to this company a right of way over the island and bridge. A contract was entered into between the United States and this company, by which it was substantially agreed that the Government should erect a new iron bridge, with draw, and grant to this company such right of way, the company undertaking, on its part, to remove the old bridge from the channel, and defray one-half the expense of the construction and repair of the superstructure. This contract has been performed by both parties, and the arrangement has proved very satisfactory. The rights and franchise thus acquired constitute an important link in the main line of the company's system of railroads.

In 1872 the Oskaloosa Branch was extended from Washington to Sigourney, the county seat of Keokuk County, a distance of 28¾ miles; in 1875, from Sigourney to Oskaloosa, the county seat of Mahaska County, a distance of 25 miles; in 1876, to Knoxville, the county seat of Marion County, a distance of 24¾ miles; making the entire length of the "Oskaloosa Branch," from Wilton to Knoxville, 128 miles. This branch, with the Indianola and Winterset lines, passes through or into eight of the best counties of Iowa, lying in the third tier north of the State line.

In 1874 a corporation known as the Calumet & Chicago Canal & Dock Company, having graded a road from a point on the line of this company's road to the harbor at the mouth of the Calumet River, 6¼ miles, proposed to convey it, with right of way, to this company, provided it would lay the track and complete and operate the road. This proposition was accepted, and the transfer completed. Subsequently an addition of 2½ miles of road, reaching the extensive iron manufactory of Joseph H. Brown & Co., was obtained on similar terms. By this branch, known as the South Chicago Branch, freight can be transferred to all of the Eastern lines of railway leaving Chicago, and to the Illinois Central Railroad, outside the city limits, and also to vessels in the South Chicago harbor—a privilege likely to become very valuable to this company at some future day.

The main line, the South Chicago Branch, and the Oskaloosa Branch, are owned absolutely by this company. They form, however, but a portion of the system of railroads operated by it upon terms as satisfactory as absolute ownership. The lines, the legal title to which is in other corporations, but which are controlled by this, are described in the following pages, in the order in which they intersect the railroads owned by the company, commencing at Chicago.

In 1854 the Peoria & Bureau Valley Railroad Company completed its railroad from Bureau Junction, on the line of the Chicago & Rock Island, to Peoria, a distance of 46¾ miles. A contract was entered into between the two companies, whereby the Rock Island became the lessee of the entire property and franchises of the Peoria & Bureau Valley Railroad, in perpetuity, at an annual rental of $125,000.

In 1869 the Chicago & Southwestern Railway Company, a corporation organized under the laws of Iowa and Missouri, commenced the construction of its road from Washington, on the Oskaloosa Branch, to a point in the State of Missouri, on the east bank of the Missouri River nearly opposite the city of Leavenworth. It desired to raise money to be used in the construction of its road, and proposed to this company the option of a perpetual running arrangement, whereby its entire business would be secured to this company's lines, or a lease which should thereafter be agreed upon by the parties, in consideration of the guaranty of its first mortgage bonds to the amount of five millions of dollars.

On the first day of October of that year a formal contract was executed between the parties, and on the sixth day of the same month the bonds, and a mortgage by which they were secured, were executed. By the express terms of the mortgage it was provided that if this company should be required, in the performance of its contract of guaranty, to pay either principal or interest of the bonds, it should be subrogated to the rights of the original holders, and should have the right to demand a foreclosure of the mortgage for its benefit. As the railway was constructed it was turned over to this company for operation, on account of the Southwestern Company. The main line was completed late in 1871. Its entire length, from Washington to the Missouri River, opposite Leavenworth, is 269 miles. While it was being built, the Southwestern Company arranged for the construction of a branch from Edgerton Junction, on the main line, to a point on the Missouri River opposite Atchison, Kan., and for the purpose of raising money to be used in such construction, issued bonds for $1,000,000, and secured the same by a mortgage, which was declared to be a first lien upon the branch and a second lien upon the main line. These bonds were not guaranteed, either directly or indirectly, by this company. Upon the completion of the main line and branch, the Southwestern Company ceased to pay interest upon either class of bonds. This company made provision for the payment of the interest coupons upon those secured by the first mortgage, as they matured, and continued to operate the Southwestern roads upon the account of that company. Not being able to make any permanent arrangement which would be satisfactory, this company, in 1874, required the trustees to proceed with a foreclosure of the mortgage of the main line as

to the interest it had paid in the performance of its contract of guaranty. In compliance with this demand, the trustees, in March, 1874, filed a bill in the Circuit Court of the United States for the district of Iowa, praying such foreclosure. A number of the Atchison Branch bondholders intervened and resisted the application, claiming that this company had assumed the payment of the principal and interest of the Atchison Branch bonds. Issues were joined, evidence taken and the cause was tried in August, 1875, when a decree was entered which fully sustained the position of this company, holding that there was no liability upon its part for either the principal or interest of the Atchison Branch bonds, ordering a foreclosure of the mortgage as to and a sale of the main line, and cutting off all lien thereon under the Atchison Branch mortgage. It also found that the Southwestern Company was a general debtor to this company on an accounting in which it was debited with all sums paid to that date, for the operation and improvement of its lines, and credited with all sums received for the transportation of persons and property over them. From this decree an appeal was taken to the Supreme Court of the United States by the Atchison Branch bondholders. The case has been submitted to the court on printed arguments. A decision affirming the decree of the Circuit Court is confidently anticipated.*

The western terminus of the main line of the Chicago & Southwestern Railroad is at the east end of the Kansas & Missouri Bridge, over the Missouri River, on the Fort Leavenworth military reservation. This bridge is the property of a corporation in which this company has no interest. It has a right, under contract, to run its trains over the bridge on the payment of toll. From the west end of the bridge to the city of Leavenworth is a distance of 1¼ miles. To complete the connection, a railroad was constructed by the Fort Leavenworth Railroad Company, organized under the laws of Kansas. This road consists of two tracks, one extending to freight grounds and a depot near the north line of the city, the other to a connection with other roads within the corporate limits, over which this company runs its passenger trains to a union depot in Leavenworth. The capital stock of this Kansas corporation is now controlled by this company.

In 1871, the Des Moines, Indianola & Missouri Railroad Company commenced the construction of its railroad, from a point on the main line of this company's road in the city of Des Moines to Indianola, a distance of about 22 miles. For the purpose of raising money to be used in this construction, it issued its bonds for the sum of $300,000, secured by first mortgage upon its entire property. This company became the owner of these bonds, and commenced the operation of the road as completed, upon an agreement to apply net earnings in payment of interest on the bonds. The net earnings of the line were not sufficient to pay in full the interest accruing, and proceedings for foreclosure have been commenced, and are now pending in the Circuit Court of the United States for the district of Iowa.

In 1872, the Des Moines, Winterset & Southwestern Railway Company constructed a railroad from Summerset, on the line of the railroad last mentioned, to Winterset in Madison County, a distance of about 26 miles. While the construction was in progress it issued its bonds for the sum of $500,000, secured by mortgage upon its entire property. These bonds became the property of this company, and proceedings having been instituted in the Circuit Court of the United States for the district of Iowa for a foreclosure, a decree has been entered in accordance with the prayer of the petition. A sale of property under the decree will be made in a few months. The two last named branches have proved quite valuable as feeders to the main line.

In August, 1876, the Iowa Southern & Missouri Northern Railroad Company was duly incorporated, with full power to purchase the main line of the Chicago & Southwestern, the Des Moines, Indianola & Missouri, and the Des Moines, Winterset & Southwestern railroads. In September it made an arrangement by which it received from the Southwestern Company a conveyance of its main line, subject to the above mentioned decree, and the rights of the holders of the outstanding bonds. The consideration paid to the Southwestern Company for the transfer was an entry of satisfaction of the amount of the judgment for the general debt to the Chicago, Rock Island & Pacific Railroad Company before mentioned, the Iowa Southern & Missouri Northern having completed arrangements with this company for such application of that indebtedness. On the first of November of the same year, a sale was made under the decree of foreclosure of the same property, and the same company became the purchaser. Payment therefor was made, mainly, with the coupons which had been paid by the Chicago, Rock Island & Pacific Railroad Company in the performance of its contract of guaranty and covered by the decree of foreclosure. The same company has also purchased of the Des Moines, Indianola & Missouri Railroad Company its railroad, extending from Des Moines to Indianola, using in payment therefor certain assets which had been transferred to it by the Chicago, Rock Island & Pacific Railroad Company. It has also completed arrangements for the purchase of the Des Moines, Winterset & Southwestern Railroad, when the same shall be sold at judicial sale.

The capital stock of the Iowa Southern & Missouri Northern Railroad Company now amounts to $3,200,600, and all but a few shares are under the absolute control of this company. This places the property of that corporation under the control of this, and it will hereafter be operated as a part of the property of this company.

While the revenues derived from the main line of the Southwestern Company, extending from Washington to Leavenworth, have not been equal to the expenses incurred by this company in improving and operating the road, a steady improvement in this regard is noted. The balance of disbursements over receipts would be considerably reduced by an allowance of drawbacks on business furnished to the roads of this company at rates which are frequently obtained by feeding lines. The franchises of the line in Missouri are deemed valuable. They were granted by special charter, and continue in perpetuity.

From the foregoing statement it will be seen that the property owned, leased, or controlled by this company, at the date of this report, is as follows:

Chicago to Council Bluffs (Main Line)	500¼	miles.
Peoria & Bureau Valley Railroad (Branch)	46¾	"
Oskaloosa Branch	128	"
Indianola & Winterset Branch	48	"
South Chicago Branch	9	"
Chicago & Southwestern Railway, including Fort Leavenworth Railroad	271	"
	1,003	miles.

* Since this report was written, the decision of the Supreme Court has been announced. It affirms the decree of the Circuit Court in every particular. The effect of this decision is to confirm the title of the Iowa Southern & Missouri Northern Railroad Company to the entire Southwestern Main Line, from Washington to the Missouri River, subject only to the outstanding main line bonds, bearing the guaranty of this company.

General Office Accounts.

[From a forthcoming work entitled "Railway Revenue and its Collection," soon to be published.]

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THE REMARKABLE UTILITY OF THE LEDGER OVER ALL OTHER BOOKS OF ACCOUNT: THE GENERAL LEDGER AND ITS SATELLITES THE SUBSIDIARY LEDGERS.

The number of ledgers required to be kept in the office of the accounting officer will vary with different companies in accordance with the length of the road operated and the extent of the business done.

Upon the smallest of our roads all the accounts can, without difficulty, be kept upon the general ledger. When this can be done, the book-keeping is very much simplified.

Upon the great roads of the country the book-keeping becomes more elaborate. The immensity of the details to be examined and arranged and the great number of accounts, permanent and otherwise, that demand incessant attention, require an additional number of accountants.

The necessity for the increase in the number of book-keepers involves an increase in the number of books. The quantity of matter to be spread upon the records is not, however, sensibly increased by multiplying the books. The increase in the number of books is rendered necessary to enable each clerk to pursue his duties at all times without interrupting or obstructing the work of his associates.

It will thus be seen that a judicious multiplication of the books of a company is consistent with the greatest possible economy; that a proper and expeditious discharge of the business of the general accounting department also demands such an increase.

The necessity for a general ledger is recognized upon every road. The side or auxiliary ledger is, however, held in little esteem by quite a large class whom we find prominently identified with the accounts of many railways.

It is perhaps not too much to say that any company is unfortunate in possessing an accountant unable to recognize the pre-eminent fitness of the ledger wherever permanency and clearness of accounts are desired. Upon its pages every conceivable transaction involving dollars and cents finds a natural resting-place. It is a veritable burying-ground, and upon its monumental pages may be traced, generations afterwards, the deeds of wisdom and of folly practiced by the men whose acts it records.

No other account book possesses the elasticity, comprehensiveness and permanency of the ledger, and all efforts to supersede it with *quasi* record-books and other make-shifts are mistakes.

With its attendant journals, the ledger pure and simple is the only fit receptacle for the general and special accounts of a railway company.

The complete elucidation of the accounts spread upon a ledger requires no special key; the ledger possesses the happy faculty of bringing together at one common centre in consecutive order all the incidents of a most complicated transaction.

With the final accomplishment of a transaction, it disappears from the balance-sheet, but the record remains upon the ledger, the account being balanced and closed.

The legend that heads each page of the ledger affords a clue to the circumstantial history that follows.

The index that forms a part of every ledger makes each account accessible at a moment's notice years after its name and the traditions concerning it have been forgotten.

Every experienced accountant understands tolerably well the mysteries of a leger, consequently everything that it contains is susceptible of explanation if we will but give it time and patience.

It is this comparative simplicity and universality of the ledger that makes it so desirable, and an accounting officer should hesitate long before replacing it, even in the minor branches of the service, with some apparently cheaper and better substitute of his own.

In instituting a plan for recording the affairs of a corporation, care and discrimination should also be exercised to select a method that, being generally understood, will be a protection to the company after the person who transcribed the accounts has passed away. Such a record may also be necessary at any moment to protect the good name of some agent of the company.

The ledger meets all of these varied requirements, and no other book or plan does or can.

The general ledger of a large railway should be little more than a record of the general accounts of the company.

A reference to the accounts coming within the scope of a general balance-sheet, as they are described in a succeeding chapter, will afford a very clear idea of the number and character of the general ledger accounts. However, many general ledger accounts are necessarily and properly consolidated in preparing a balance-sheet of such a description.

As already mentioned, the number of current accounts that require attention are much greater than the general ledger will hold.

It thus becomes necessary to provide side ledgers to accommodate the business.

Each side ledger should be arranged to record the accounts of some particular branch of the service.

A ledger account should be opened with agents, conductors and other employes who receive or disburse the company's funds; a ledger account should also be opened with all individuals who are in debt to the company or have mixed dealings with it.

The opening of a ledger account in the cases mentioned will prevent confusion as well as preserve a continuous and authentic record.

The prompt entry of such accounts upon the books at the time the transaction occurs will prevent the loss that must inevitably accrue from any neglect to do so.

The delay that occurs in collecting many accounts is sometimes very great. This delay is occasioned by dispute in reference to the correctness of the account from the inability or indisposition of persons to pay, and from various other causes.

In all such cases it is obvious that the account is very likely to be lost, overlooked or forgotten, if it has no other abiding-place than a pigeon hole in the treasury.

The extent of the business of a railway requires that a ledger account should he kept for each debit account.

The volume and rush of the business of to-day obliterates all recollection of the affairs of yesterday. The virtue then of a ledger account is, that so long as it remains unbalanced, it stands a perpetual spur and reminder to the financial agent.

Without this reminder, the financial officer, occupied with current matters, overlooks the unpaid account, and ends by forgetting it.

A ledger account has this further merit that it makes apparent all the minutiæ of a transaction extended over a long period of time.

The debtor pays in driblets as he can, and the complete payment of the account is not perhaps consummated for years; nevertheless every little installment has its appropriate place in the compact line, and nothing can be overlooked or forgotten.

As many subsidiary ledgers of each class can be used as may be necessary, the ledgers being arranged so that each embraces a given number of letters in the alphabet.

It would seem to be quite unnecessary to devote so much space to a matter about which there could apparently be no difference of opinion; nevertheless, it is true that the system of book-keeping is exceedingly imperfect upon a great many railways.

The defect arises from a false idea of economy; from a belief that blotters and slips of paper are good and sufficient substitutes for common books of record; from an honest though mistaken attempt to simplify matters, and, finally, from a nervous dread lest some person may say of them that their system is expensive and complicated.

A further and very conclusive reason why a ledger account should be opened in each instance may be mentioned: the Local Treasurer should, so far as it is possible, be prepared in an instant to particularize his collections; he should be prepared to show how much he has collected from particular persons, with such other information as may be necessary to impress an intelligent person with the conviction that he is clear and upright in the discharge of his trust.

In reference to the accounts that are wholly against the company, it is perhaps unnecessary for the Local Treasurer to open a ledger account with each person.

Information in reference to the amount the company owes on such accounts is easily obtainable in a less cumbersome and expensive way. And besides in the event such an account is overlooked or forgotten, or for any reason remains unpaid, the company does not suffer a loss as it does when an account due to it is allowed to lapse; on the contrary, the omission enures to its benefit.

It is customary with railway companies to make a voucher in favor of every person, firm or corporation to whom they may be indebted.

A ledger account should, in all cases, be opened with the creditor in the department of the road where the debt is incurred and the bill vouched for.

When paid, the receipt of the payee is attached to the voucher itself.

In this way it is impossible to pay too much, and, what is very desirable in a voucher, it possesses immediate and palpable evidence of authenticity that a ledger account of course does not.

In reference to the use of side ledgers, a description of one is practically a description of all.

Upon the general ledger, an account will be opened with, say "*Station Agents and Conductors.*"

The *aggregates* only are charged and credited to this account on the general ledger, the balances on the latter being brought down monthly.

Upon a side ledger an account is opened with each agent and conductor.

All the details are represented with considerable perspicuity on this ledger. Each agent and conductor is severally charged and credited with the various amounts that belong to him. The balance standing to the debit or credit of each agent and conductor is ascertained monthly. The difference between the total footings of the balance sheet, as drawn from the station agent's and conductor's ledger, should agree exactly with the balance standing on the general ledger under the general head of *Station Agents and Conductors* as already explained. If it does agree it demonstrates generally the accuracy of both the ledgers.

To sum up, the side ledger gives the individual accounts; the general ledger gives the aggregate of these accounts.

The number of subordinate ledgers required will, of course, vary with the extent of the matter that must find a place of lodgment. Upon some roads, the details of the accounts with "station agents and conductors" can be embraced in the same ledger with "railway companies' and foreign ticket agents'" accounts, or with "various persons" (*i. e.*, charges against individuals and corporations, excluding railways).

Supposing the two former accounts to be merged, the name of the account upon the general ledger would then be "station agents, conductors and railway companies."

Every account opened upon the ledger should be carefully indexed at the time.

When the name of the account is at all likely to be misunderstood, it should be indexed under different letters, such letters as a person would be likely to examine in hunting up the account. It should be the aim in this, as in everything else, as far as possible, to make the record so perfectly clear that even a comparatively ignorant or stupid person could unravel it. It is better to recognize the existence and possibilities of such people than to be damned by them.

In connection with the railway companies' and foreign ticket agents' ledger, it will frequently be desirable to open several accounts with each road. For instance, a ticket account should be opened with each road; also a freight account when a joint business is done; when cars are interchanged a car service account should be opened; and, finally, a miscellaneous account should be opened with each company when necessary. The miscellaneous account should include all debits and credits, not covered by the other accounts, such as overcharges, rebates, losses, damages, repairs of equipments, baggage checks, etc.

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Editorial Announcements.

Passes.—*All persons connected with this paper are forbidden to ask for passes under any circumstances, and we will be thankful to have any act of the kind reported to this office.*

Addresses.—*Business letters should be addressed and drafts made payable to* THE RAILROAD GAZETTE. *Communications for the attention of the Editors should be addressed* EDITOR RAILROAD GAZETTE.

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

IRON CARS.

There has been a good deal of talk during the past few years about the construction of iron cars. We speak of it as "talk" because it has seldom reached the dignity of a careful investigation of the subject, but has very generally been only an easy-going, gossipy kind of conversational allusion to it, in which those things which first occurred to the talker, and which required the least thought, were said and dwelt upon. In many of these lucubrations the paramount question was lost sight of, which is the relative cost of service of the two kinds of cars. Engineers and mechanics are, by the way, quite too prone to disregard that question, which, instead of being only an incidental one in matters of this kind, is the one vital issue on which the "to be or not to be" of iron cars is entirely dependent. If iron cars can be built at such a cost and have sufficient endurance so that the service they render will cost less than that of wooden cars, then it is quite certain that they will be adopted, but if their service costs more than that of wooden cars, then they will never be generally introduced. Their cost is the one primary essential consideration which must be kept in mind all the time and must never be lost sight of.

It, then, iron is used instead of wood in the construction of cars, it must be because iron has some advantages over wood which will make its ultimate cost less. The one great argument which is used in favor of iron is that it does not decay. Now while this may be an advantage in some cases, in others it is of little importance. Thus, for a number of years past locomotive tender frames have been made of channel iron bars, and it is generally thought that such frames are more economical than wood, because, owing to the leakage of the tanks on tenders, which it is almost impossible to avoid entirely, the tender frames are constantly exposed to moisture and thus decay very rapidly. Now while, in spite of their extra cost, iron may for this reason ultimately be more economical than wood for tender frames, it may not be for passenger cars on which the timbers are protected from moisture. We may take another illustration: for the outside panels of a passenger car a very thin sheet of iron would be as strong as a wooden board panel very much thicker. But with a thin iron plate, so much surface is exposed to corrosion that it is more difficult to protect it from that cause of destruction than to preserve wooden panels from decay. For this reason wood for such purposes is cheaper than iron.

There is another principle applicable to iron and wooden construction which determines the material that can be used most economically. This has been worked out very thoroughly in the design of wooden and iron bridges. In ordinary rectangular trusses, if they are built of wood, as in the case of the Howe truss, the longest or diagonal members are subjected to strains of compression, because wood has a comparatively low tensile strength, but, being a more bulky material for a given amount of strength, it is less liable to deflect sideways when it acts as a post than iron is. Therefore for the long members of a bridge wood can be used more economically if subjected to strains of compression than it can in tension. In iron bridges these conditions are usually reversed, that is, the short members are subjected to compressive strains and the long ones to tension, as in the Pratt truss. This same principle is applicable to car construction, and it may be another reason why iron is economical for tender frames, which are comparatively short, but might not be for passenger cars, the frames of which are long. Of course the application of this principle is very much modified by the improvements made in the manufacture of iron intended to be used as beams and the facilities which now exist for supplying various forms of such beams. Thus as long as twenty-five years ago iron coal cars were used on the Baltimore & Ohio Railroad. These cars had sheet or plate-iron bodies, composed of several conical sections united together; but the frames, although only about 16 feet long, were made of wood, because at that time it was impossible to have channel or I beams manufactured. At present probably this form of construction would be found cheaper than wood.

There is also another principle which has some influence in determining the material to be used. We refer to the hardness of the one material and the compressibility of the other. Thus for such purposes as for the end or "bumper" beams, wood is obviously the best, for the reason that it will resist the shocks, to which those parts of cars are exposed, better than iron, unless some special appliance, such as buffer springs, is added for the purpose of giving elasticity. When subjected to a sudden blow, wood will be compressed, and thus relieve the force of the blow, whereas iron would resist, and thus receive the full force of the concussion. In other positions, however, this very compressibility is a serious objection. This is the case when the wood is subjected to strains of compression greater than it will resist. An illustration of this is furnished in wooden bolsters. These, with heavy cars, cannot be made strong enough without trussing them with iron rods, owing to the limited space which they occupy. The same cause makes it necessary to place the truss rods at a very small angle to the beam, and they are therefore subjected to very great tensile strain, which must be resisted by the bearing of the truss rod nuts on the end of the bolster. This pressure becomes so great that the wood is sometimes partly crushed, which also occurs where the centre plate bears against the bolster. For this reason iron bolsters made in the form of a simple truss are much used, and are found to resist the strains to which they are subjected much better than wood.

This same reasoning might, it is thought, be applied to draw-bar timbers and iron be substituted for them instead of wood, with as much success as it has been for bolsters.

The use of iron instead of wood in the construction of cars will, it is believed, come about gradually. It is now being applied perhaps quite as fast as our experience and knowledge will admit of. Iron will be used instead of wood in car construction because the qualities of the one are better adapted for certain purposes than those of the other, and will not be for any other reason. Iron trucks have now come into very extensive use for freight cars, and on one road at least—the Chicago, Burlington & Quincy—iron passenger car trucks are now used.

There are parties who sometimes seem to think that iron will be used instead of wood in the construction of cars because some firm or company have unemployed facilities for producing the iron. As there is no connection whatever between the cause and effect in such cases, the one has always refused to follow the other, and all who speculate about this subject may rest assured that if iron is substituted for wood in cars it will be because there is some good reason for it, and unless those who undertake to make such a substitution can find a good reason, they would better wait until one appears. The probabilities seem to be that iron will be used hereafter in those places and for those purposes for which it is better adapted than wood, but that wood will not fall into disuse entirely, for the same reason.

THE CHICAGO, ROCK ISLAND & PACIFIC RAILROAD.

This company accompanied its last report with a valuable sketch of the history of the corporation, which we reproduce elsewhere. This gives a more definite account of the company's property than was obtainable heretofore; for the company's reports, though in many respects excellent, have heretofore withheld information important to a due appreciation of the value of the property. For instance, the South Chicago Branch, acquired in 1874, has not been included in the mileage reported until this year, and there has been heretofore no account of the tenure by which the Indianola and Winterset branches were held. There is still lacking any detailed account of the operations of the 270 miles of the Chicago & Southwestern. We only know what we can gather from the fact that in the balance sheet for last year there is an increase of $350,000 (the regular guaranteed interest) in the amount charged as "advances to pay coupons Chicago & Southwestern Railway," and an increase of $50,118.59 in the other charge for "advances to Chicago & Southwestern Railway Company." The totals of these charges are now $1,969,712.49 for coupons and $1,716,543.88 for other expenditures, so that it appears that this road has cost the Rock Island Company during the five years that it has been worked $3,686,256 more than its gross earnings, and the amount of the deficit last year was $400,118. As the road when delivered to the Rock Island Company was fresh from the contractors and very imperfect, it is reasonable to suppose that a considerable part of the expenditures on it in excess of the guaranteed interest have been for improvements, and not due solely to the failure of gross earnings to meet working expenses. However incurred, the expenditures of the Rock Island Company on this road are now equivalent to $13,703 per mile, exclusive of interest on the advances; and this with the guaranteed bonds amounting to $5,000,000 makes the cash cost of this branch to the Rock Island, which is now substantially the owner of it, $32,293 per mile. Fortunately the $13,703 per mile has been paid, and the only obligation remaining is the mortgage of $5,000,000—$18,590 per mile.

The publication of this sketch of the corporation history suggests the propriety of compiling a summary of its operations meanwhile—the growth of the road in mileage and equipment, of the capital account, of the traffic, earnings and expenses, and of the net profits.

If we take the figures for 1872 and 1877, five years later, we have the following as indicative of the progress in five years. The property was:

	1872.	1877.	Increase.	P. c
Miles of road owned	565	685	120	21.2
" " worked	612	732	120	19 6
No. of locomotives	182	229	47	25.9
" passenger train cars	93	121	28	30.1
" freight train cars	3,701	4,257	556	15.0

Meanwhile the progress in the capital account representing this property was:

	1872.	1877.	Increase.	P.c.
Capital stock (issued)	$19,000,000	$20,980,000	$1,980,000	10.4
Funded debt	8,702,140	10,000,1 0	1,297,960	14.9
Total	$27,702,140	$30,980,100	$3,277,960	11.8

The gross earnings, expenses and net earnings meanwhile have been:

	1872.	1877.	Increase.	P.c.
Gross earnings	$6,121,798	$6,917,657	$795,859	11.5
Working expenses	2,950,263	3,533,194	582,931	16.6
Net earnings	$3,171,535	$3,384,463	$212,928	6.3

The yearly fixed charges for interest and rentals and the excess of net earnings over these charges have been (including guaranteed interest on Chicago & Southwestern:

	1872.	1877.	Increase.	P.c,
Interest and rentals	$1,084,175	$1,165,000	$80,825	7.5
Excess of net earnings	2,087,360	2,219,463	132,103	6.0
Equivalent to per cent. on stock	10.98	11.21		

The above earnings were made from the following traffic:

Carried one mile:	1872.	1877.	Increase.	P. c.
Number of passengers	38,540,595	60,634,585	22,093 990	36.4
Tons of freight	168,764,688	276,199,164	107,434,476	38.9

It will be noted that while the traffic has increased about 38 per cent. in amount, the earnings therefrom have grown but 11½ per cent. and the expenses but 16⅔ per cent. The former has been due to the reduction in the rates, as follows:

Receipts—	1872.	1877.	Decrease.	P. c.
Per passenger per mile	3.617 cts.	2.923 cts.	0.694 ct.	19.2
Per ton per mile	2.490 "	1.710 "	0.780 "	31.3

and the latter to a great reduction in expenses, as below (counting the proportion of expenses to receipts the same on passenger and freight traffic):

Expenses—	1872.	1877.	Decrease.	P. c.
Per passenger per mile	1.809 cts.	1.476 cts.	0.333 ct.	18.4
Per ton per mile	1.245 "	0.872 "	0.373 "	30.0

The reduction of expenses has been so great as to deserve special examination. An analysis of the reports for the past six years shows that, in the first place, there has been a better utilization of rolling stock, the engines and cars running more miles per year and the trains carrying larger loads, as shown below:

Average—	1872.	1873.	1874.	1875.	1876.	1877.
Engine mileage	24,400	26,800	26,100	27,500	26,600	27,500
Pass. mileage per pass. car	414,000	415,000	460,000	490,000	503,000	500,000
Ton mileage per freight car	45,500	55,800	59,300	69,800	62,300	64,000
Pass. train load, No.	39.3	42.0	47.5	53.8	58.2	61.5
Freight train load, tons	65.0	73.0	75.6	81.0	74.4	85.5

Here it appears that on the average an engine ran 12.3

per cent. further last year than in 1871–72, and that the work of a passenger car was 20.8 per cent. greater and of a freight car no less than 40 per cent. greater, while the average passenger train load increased 56 per cent., and the average freight-train load 33 per cent. These figures are a sufficient explanation of the economy of expenses, though of course the lower cost of materials and labor have contributed. This road's reports have a feature which we do not find elsewhere and is quite valuable, that is, a statement of the total number of men employed and their wages. These have been as follows:

	1872.	1873.	1874.	1875.	1876.	1877.
Total	3,876	4,053	4,104	3,839	4,307	4,251
No. per mile	6.36	6.00	6.08	5.68	6.15	6.00
Average monthly wages	$45 00	$45 00	$44 50	$43 50	$42 30	$39 80

Thus not only is a great deal more work done per train mile, but a little less labor is employed and lower-priced labor. The number of train miles run yearly per man employed (in all departments) increased from 921 miles in 1871–72 to 1,033 in 1876–77, and the expense for labor of all kinds per train mile fell from 58.6 cents to 46.3 cents within the five years.

The working expenses in detail per train mile will appear as follows on examination of the several reports:

	1872.	1873.	1874.	1875.	1876.	1877.
Maintenance of Way:—						
Track and roadway repairs	12.0	11.6	12.3	11.0	12.0	12.0
Track renewals (new iron)	6.5	8.9	8 4	7.6	6.5	7.9
Bridges and buildings repairs	5.2	4.1	5.1	4 1	3.8	3.2
Total	23.7	24.6	25.8	22.7	22.3	23.1
Maintenance of Equipment:—						
Engine repairs	4.0	4.3	5.2	5 0	5.0	5 2
Car repairs	9.3	11.1	10.1	8.0	8.3	6.6
Car rents	0.3	0.4	0.7	1.1	1.2	1.2
Total	13.6	15.8	16.0	14.1	14.5	13.0
Fuel and Train Supplies:—						
Fuel	7.8	8.7	9.2	8.7	8.4	8.6
Oil and waste	1.2	1.2	1.3	1.3	1.5	1.2
Total	9.0	9.9	10.5	10.0	9.9	9.8
Train wages	11.3	11.8	12.1	12.2	11.9	12.6
TOTAL ROAD AND TRAIN EXPENSES	57.6	62.1	64.4	59.0	58.6	58.5
Station and Miscellaneous:						
Station service	17.5	15.3	14.8	14.0	14.0	15.0
Loss and damage	1.0	0.9	1.4	1.1	1.2	0.7
Taxes and legal expenses.	3 5	6 7	4.5	7.2	5.2	5.5
Miscellaneous	3.4	3.0	3.9	3.3	0.9	1.0
Total	25.4	25.9	24.6	25.6	21.3	22.2
GRAND TOTAL	83.0	88.0	89.0	84.6	79.9	80.7

The change in the totals is not very great, it is true but when it is considered that meanwhile the average train loads have increased more than one-half for passenger and one-third for freight trains, it is very great indeed.

Entering into details, we find the maintenance of way expenses have varied but little, and that the charge for track renewals has increased more than one fifth since 1872, though meanwhile the price of rails has fallen one-half—an indication that the road has not been neglected. Engine repairs have also increased, and nearly in proportion to the train loads, but car repairs are greatly reduced.

The whole shows notable progress in reducing expenses, chiefly due, as before remarked, to the more effective use of rolling stock and the greater train loads. The expenses per train mile are exceptionally small, and this is probably partly due to a large allowance for switching in freight train mileage, as is further indicated by the small average freight-train load, which even last year was but 85½ tons against 179 tons on the Lake Shore & Michigan Southern, 141 on the Chicago & Alton, etc. The value of the figures is for comparison of one year with another on the same road. To compare different roads with each other, we should have strictly the revenue train mileage, with no allowance except for the distance from starting point to destination.

The Cost of Lubrication.

A few days ago a gentleman well known as a manufacturer of railroad material called at the office of the *Railroad Gazette* and propounded the question: "What does it cost to oil railroad cars?" The reply was that no one knew. Before "giving it up," however, we referred to that mine of valuable information concerning railroad management, we mean Mr. Fink's reports of the Louisville & Nashville Railroad, and found there that the cost of oil and labor of applying it is given in the report of 1875–1876 both for passenger and freight cars, and also the total distance run by each, from which the cost per car mile is of course easily deducible. This cost is as follows:

	Main line alone.	
	Passenger.	Freight.
Cost of oil and waste per car per mile	0.221 ct.	0.094 ct.
Cost of labor per car per mile	0.066 "	0.039 "
Total cost of lubrication per car per mile	0.287 ct.	0.133 ct.

It is extremely doubtful, we think, whether one railroad manager in twenty has any idea at all of the cost of lubricating cars or any means of making comparisons between the cost of one year with another or of one road with another. This is owing to the fact that hardly any roads keep any account of car mileage. Of course, by knowing the amount of money expended for oil one year and comparing it with another, it can be known how much the actual expenditure was, but an intelligent comparison is impossible without reducing it to the cost per car per mile, because one year the cars may make very great mileage and another year very little. Then, too, comparisons of the cost on one road with that on another are impossible unless the cost is reduced to a common standard of the distance run. Before it is possible to measure accurately the cost of this part of railroad operation, it is therefore necessary, as it is for a good many other things, to know the distance run by the cars, as well as the actual cost of oil and of the labor in applying it.

The discussion at the last convention of the Master Mechanics, and also of the Master Car Builders, show that, like a good many other items of expense, the cost of lubrication is receiving more attention than has ever been given to it before. On a number of roads, too, it has become a regular matter of business carefully to inspect and test the oils which are received. These tests are both chemical and mechanical. Expensive machines have been constructed, and instruments of various kinds are employed to determine the value of oils which are bought. Undoubtedly these investigations will lead to useful results, and before oil is applied to cars, it is important that the buyer should have some means of knowing its value. Within certain limits, this information will be supplied by careful inspection and practical tests. It should, however, be kept in mind that the value of oil is due to its effectiveness in oiling cars and engines, and not testing machines. The purpose aimed at in applying oil is to run the cars with the least friction and trouble from heating, and not to buy an article which will come up to certain arbitrary tests. Of course the object of the tests is to determine before using the lubricant whether it is of good quality, but what we want to impress here is the lesson taught in the homely saying that the "proof of the pudding is in the eating." Now in the case of lubricants, there is no method of testing them so effective as actual use, and no report of their quality will have nearly the value that a careful record of the cost of oiling, the number of hot boxes, and other items of information would have, if they were constantly kept and tabulated.

At the Master Car Builders' Convention the relative merits of large and small journals were again discussed, as they are nearly every year. In an informal discussion between two of the members of that association, one of whom has charge of one end of a long through line, and who is in favor of and is using large journals on a considerable number of cars, while the other has charge of the other end of the line and believes in a smaller journal, the small journal man stated that on his end of the line he had a great deal more trouble with the large journals from heating than with the small ones; the other man insisted that the chief trouble on his end was from the small journals. Now it is believed that each one of these was equally honest in his convictions, but neither of them based his opinions on anything excepting mere casual observation, which is often one of the most misleading guides. If a record were kept in which every hot box was recorded as inexorably as fate, such contradictory opinions would be impossible, and it would soon appear which kind of journal gave the most trouble. The same thing would be true of brasses and oil-boxes; and if the cost of oil per car per mile was made up each month, and the kind of oil used was also given, the relative cost of different kinds of oils would very soon be apparent from an examination of the records. Testing oils with instruments expressly designed for that purpose is undoubtedly very useful, but the only machines or instruments which should be implicitly trusted are the cars themselves. The knowledge which can be gained from these will, however, not be useful unless careful records are kept. This can be done by any car-builder in the country, simply with the help of a little cheap clerical labor and some slight attention in organizing a system of reports. Before railroads can be managed as economically as they should be those in charge must know and be able to tell what becomes of the money they expend. In no one item do they now seem to be so ignorant as in that of the lubrication of cars. Quite curiously, too, after all the experience of these many years and all the experiments which have been made, no general principles or laws which govern this question of lubrication seem yet to have been evolved, and the whole subject seems to be involved in as much obscurity as ever.

Record of New Railroad Construction.

This number of the *Railroad Gazette* has information of the laying of track on new railroads as follows:

Burlington & Lamoille.—Extended from Jericho, Vt., northeast to Cambridge, 16 miles, completing the road.

Denver & Rio Grande.—The *La Veta Branch* is extended from Sangre del Christo Summit, Col., to Grayback Gulch, 7 miles. It is of 3 ft. gauge.

This is a total of 23 miles of new railroad, making 618 miles completed in the United States in 1877, against 673 miles reported for the corresponding period in 1876, 401 in 1875, 637 in 1874, and 1,408 in 1873.

ERIE CANAL TRAFFIC continues very unsatisfactory to the State, and not profitable, it would appear, to the boatmen. Down to the end of June the number of clearances at Buffalo was 1,394 this year, against 1,480 last, while the tolls have fallen from $184,173.65 last year to $88,714.16 this, the decrease being 52 per cent. There is thus such a falling-off of tolls as to make it difficult to see how the canal can be maintained from them for another season's traffic. The boats are getting a much larger *proportion* of the grain than last year, but a smaller *amount*, and the reduction in tolls is more than counterbalanced by the reduction in rates, so that the boatmen seem to have less to do and lower wages than last year, when they affirmed that they were not paying expenses. There have been some new developments in traffic, one being some considerable lard and provision shipments by this route, which, if imitated, would take an important business from the railroads, or force them to reduce their rates on this business. Perhaps this canal competition had a considerable influence in determining the recent reduction which was made July 1, though the total shipments of provisions by canal down to July were but 2,900 tons. The other new canal traffic is a considerable increase in anthracite coal shipments westward. This is caused by a new competition of coal companies for the supply of the Western market. This business has heretofore been confined chiefly to companies which shipped from the mines directly to the railroads on the canal north of the anthracite region; but now the companies which have no outlet to the north are entering the field and shipping from their coal depots in New York. As the boats usually have to go back to Buffalo light, they can afford to carry westward at a very low rate. But as the market for anthracite in the West can be greatly enlarged by a reduction in price (which is not true to anything like the same extent in the East), this growth of a coal traffic on the canal may be an addition to the traffic rather than a diversion of it from rail to canal. The Erie is a large carrier of anthracite to Buffalo, and a considerable amount is also delivered there by the New York Central, from the lines which intersect it. It has continued to be a profitable traffic to the railroads, notwithstanding the great reduction in the price of coal since last year, and now, we suppose, pays the trunk lines as much as the average rate for other freights.

THE HOUSTON & TEXAS CENTRAL first-mortgage coupons due July 1 were cashed on presentation at the usual time, but not by the company, the announcement being made that they would "be purchased at par, in gold, * * by Messrs. John J. Cisco & Son, No. 59 Wall street, for account of Mr. Charles Morgan." Mr. Morgan is a director of the company, and Mr. Cisco its Treasurer. It is to be assumed that the purchase was made by him because the company had not the money. The possession of the coupons unpaid by the company will give the holder the right to foreclose for non-payment of those coupons. If such a foreclosure should be effected, it would extinguish the consolidated mortgage as well as the stock, but would leave the first mortgage in force for the principal and all subsequent coupons. It does not follow that Mr. Morgan will foreclose on the coupons which he has purchased. He is supposed to own a majority of the stock, and may take this course—virtually loaning money to the company on a first mortgage—to prevent a foreclosure. And the possession of the coupons may make him master of the situation, and have an influence on the floating-debt creditors, who might otherwise be inclined to reject the plan of settlement offered them. If any dependence can be placed on the reports of earnings and expenses heretofore published, the road has always earned the interest on both classes of bonds, and a considerable margin over, and the excellent crops in Texas this year promise it at least as good an income as ever before.

It was, of course possible for bondholders to refuse to sell their coupons to Charles Morgan, and to demand payment of the company, and in the event of its refusal to pay, to sue for foreclosure in the manner provided for by the mortgage. Probably, however, the holders were only too glad to get their money, and not particular whether it was paid by the company, which owed it, or by an individual, who did not owe it.

THE SOUTHERN RAILWAY ASSOCIATION held its convention in New York, as announced, and the result was more satisfactory than was expected, apparently. This combination has been, on the whole, ineffective, because, as it seems, there has been a shocking lack of good faith on the part of some of the companies belonging to it, and no way to enforce the agreement. The proposition of the Commissioner of the Association, Mr. Virgil Powers, to require a deposit with the Commissioner of 25 per cent. of the freight moneys as a guarantee, was, we understand, substantially agreed to, so that there is likely to be some check hereafter on the conduct of the several parties to the agreement. Woful stories are told as to the acts of some of these Southern railroad managers, and the Commissioners have not hesitated to describe these acts as utterly dishonorable and unworthy of any business man. The fact is, the morals of railroad business seem to require time for development, as well as everything else, and a great deal of what is now done in the dealings of railroad companies with each other seems characteristic rather of boys or of a half-civilized people than of reasonable business men chosen in an enlightened community to conduct the most important commercial interests. It follows from this not that effective combinations and agreements are impossible, but that they must be planned and directed to suit the actual condition of things, unsatisfactory as those are. One of the requirements seems to be some guarantee that the contracting parties will fulfill their contracts. It is common to require this of individuals when important contracts are made; but there

seems to be some hesitation in providing a guarantee when the contract concerns a method of action or a policy instead of a sum of money or a piece of tangible property, though a vast if indefinite sum of money may depend upon the execution of the policy as provided in the contract. At all events, it will not do to agree that such and such things shall be done and that such and such things shall not be done, and then leave the agreement to execute itself, or fail to determine how it shall be executed; yet this is substantially what has been done sometimes.

POOLING TRAFFIC seems to be contagious. No sooner is the New York city pool on west-bound freight fairly established than two others are announced: one between the New York Central & Hudson River and the Erie for local business at and west of Rochester, where the roads are inconveniently near together and there is a very heavy local traffic; and one between the lines carrying live stock from St. Louis. In the former case a remarkable condition of things has existed for about a year. The Erie has made special rates for passengers from New York to Buffalo, Niagara Falls, Rochester, and, we believe, some other points where it competes with the Central, by which the passenger, under certain limitations, had a rebate of $1.50 to $2 paid to him, giving the passenger who could travel within the limitations fixed an advantage to that amount which he could not get by the Central; for the latter never met this reduction, but maintained its rates, and permitted the Erie to gain what it could by the lower rate. The Erie gained passengers in considerable numbers, and the Central lost; but in spite of the considerable amount of the difference—as much as a quarter of the whole fare—the diversion of traffic from the Central was not sufficient to convince its managers that it would do better to follow the reductions of its competitors. That is, the net profits of the reduced traffic at the full rates appeared to be considerably larger than could be secured from the larger traffic at the reduced rates. There are not many cases, probably, where this would be true; for in most cases that road will get all the traffic which offers for five dollars what another road will only give for seven.

The live stock pool is important because the St. Louis rates, though they do not apply to the largest part of the cattle traffic, still affect nearly the whole of it west of Indiana. Whether cattle are carried to St. Louis, Chicago or Indianapolis depends largely on the rates to the East from these places respectively. If the difference is greatly in favor of Chicago, then the Texas cattle, shipped chiefly in Kansas, are likely to go there rather than to St. Louis; if there is little or no difference, then St. Louis gets business which otherwise would have gone to Chicago. The difference in distance is about 12 per cent. in favor of Chicago; the agreed difference in rates of 5 cents per 100 lbs. is not quite so great in proportion, but enough, so the Chicago roads agree, to prevent an undue diversion of the traffic. Live-stock business from Chicago has been pooled for some years.

A REDUCTION OF EAST-BOUND RATES went into effect July 1, the charge per 100 lbs. from Chicago to New York falling from 40 to 35 cents on fourth class, and other changes being made on pork products. According to the wording of the telegram announcing the changes, rates are made the same to Boston as to New York, while they are usually 5 cents per 100 lbs. higher on the lower classes. This is permissible by the trunk lines' agreement, which provides that Boston rates shall not be lower than New York rates, while Philadelphia rates shall be 2 cents and Baltimore rates 3 cents lower. The reduction, and the fact that it applies chiefly to provisions, indicates that the lake and canal route has been making such a diversion of this business, before almost exclusively a rail or lake-and-rail traffic, that it was felt necessary to do something to prevent it. It is hardly possible that the canal will continue to get an important part of this business. It can carry cheaper than the railroads, but not so much cheaper, as it could several years ago, and then the railroads got it all. The railroads may not be able to collect as high a rate as they would like, but it will not be necessary to carry at an unprofitable rate in order to prevent the diversion of the provision traffic to the canal.

THE CONICITY OF DRIVING WHEELS is the subject of an inquiry by a correspondent, who says: "Has anything ever been said in your paper as to the best bevel or cone to be given to the tires of driving wheels? I am inclined to think it is generally too great for the durability of the track, and I would be glad to hear intelligent views concerning it."

We do not know that this subject has ever been thoroughly investigated. Unless the axles of an engine or car are arranged so as to assume radial positions to the curves on which they run, the coning of the wheels has not much theoretical value. Even if the axles were so arranged, the fact that if the wheels when new are made conical they soon lose the cone by wear shows that the conical form is not of much practical importance.

EXTORTION is decided to have been practiced by the late Toledo, Wabash & Western Railway Company, and it has been fined $1,000 therefor by an Illinois Court. It seems unfortunate that while it was in the extorting business it did not "extort" enough to keep itself alive. As it is, it has had to give up the ghost for want of money enough to pay interest on its mortgage debts, and sundry stock and bondholders are painfully impressed with the idea that it is they, the proprietors of the road, and not its patrons, who have suffered from extortion. The man whose hundred shares of Wabash stock were worth $8,000 five years ago and are worth nothing now is likely to hear with astonishment that his company ever took too much money.

By the way, what is to be done when the fines and penalties of the law are declared against a company which has become bankrupt between the bringing of the suit and the rendering of the decision? Is the fine which the court may declare a lien prior to all mortgages? Can the Sheriff collect from the Wabash Company a fine entered against the Toledo, Wabash & Western after the latter's property had been sold to the former to satisfy a mortgage? If so, it will be important to add to the inventory of a bankrupt company's estate offered at auction a list of the "granger suits" pending against it, as contingent prior liens for indefinite amounts.

Contributions.

Wrought-Iron and Cast-Iron Car Wheels.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Being a manufacturer of wheels and an attentive reader of your valuable journal, I have read with much interest the articles which you have recently published on the manufacture of car wheels, their average mileage, and also their average cost per mile run. I now ask you to be good enough to insert the following article, which will make it possible to compare the Arbel wheel and the different types of wheels manufactured and used down to this time.

One of the great disadvantages of cast-iron wheels with chilled tires, the use of which has extended throughout America, is that it is impossible for the maker to secure wheels of the same diameter. It is necessary to bring together upon the same axle wheels of the same diameter; and it is not rare after same service to find differences of 4 to 6 millimetres (0.16 to 0.24 in.) in the diameters of the two wheels; this causes abnormal slipping, a more rapid wear of the small wheel, and a certain deterioration of the rails occasioned by the flange of this same small wheel.

With wheels of the same diameter, moreover, a more rapid wear is observed than when wrought-iron wheels with iron or steel tires are used. Cast-iron brake-blocks likewise also cause disastrous effects on cast-iron wheels: the enormous pressure of this hard material on a surface moving at a speed of 40 to 70 kilometres (25 to 43 miles) per hour and which cannot be cooled from the interior heats the tread and hardens it as soon as it meets a moist place, and as these wheels do not endure well inequalities of dilation, it follows that numerous breakages of wheels take place while in service, and cause terrible accidents, such as have occurred recently in America and in Canada.

Therefore the use of cast-iron car wheels is formally prohibited on the French railroad system, and the use of them in Europe is now very rare, and is entirely forbidden for cars with brakes: it is the same with wheels wholly of cast steel, such as those made by Krupp or Bochum.

Cast-iron wheels have an extremely variable life. At the Car Builders' meeting in New York, Dec. 21, their average service was estimated at 40,000 miles by Mr. Chamberlain; it rose in an exceptional case to 50,000 miles for a lot of 2,000 wheels made by this manufacturer. This was due, as was well remarked by Mr. Garey, to the particular attention paid to the manufacturing as well as to the selection of the iron used in this case. The maximum service was about 115,000 kilometres (72,000 miles), and the minimum about 8,200 miles, the load being 5,500 lbs. upon each wheel.

With the greater number of makers, this average does not exceed 31,000 miles; but to avoid any criticism on the conclusion which follows, I will assume that it is about 40,000 miles and that this service is accomplished in one year.

I will eliminate from this comparison the Hamilton, the Atwood, the Raddin and the Handyside wheels, which are too heavy and costly, or too light and weak, and afford a small mileage. Neither will I mention the wheels of compressed paper with a metal centre and steel tire, these wheels costing twice as much as ordinary wheels, and being unable to withstand the action of the brake. I will speak only of the four following wheels, supposing them of the same diameter of 42 in. (1,070 millimetres) on the outside of the tire, which is that adopted by the Pennsylvania Railroad and several other companies:

1. Cast-iron wheel with chilled tread.
2. Cast-iron wheel with steel tire (Sax & Kear's system).
3. Steel wheel, cast with its tire (Krupp's system).
4. Spoke wheel of wrought iron with iron or steel tire (Arbel's system).

Before instituting this comparison, I shall say a few words on the great advantages which the Arbel wheel offers over the three other types. I will not enter into the details of its manufacture: these were published in the *Railroad Gazette* of June 23, 1876. A paper on the same subject was read at Philadelphia at the last meeting of the American Institute of Mining Engineers by Mr. Henry, and this paper will be published in the fifth volume of the "Transactions" of the Institute.

Compared with all other processes hitherto employed, the Arbel process is certainly, as will appear further on, more economical than any of them. It realizes a considerable advance over them all in regard to durability and strength, and assures absolute security.

Every part of this wheel is made in such a way that the sections are proportioned to the strains which they have to sustain, and they consequently offer the maximum resistance for a minimum section.

What characterizes this system is that the same process is applied to all kinds of wheels—hand-car wheels, street-car wheels, car wheels, tender wheels and locomotive wheels, and likewise to wheels of all diameters, from 200 millimetres (8 in.) up to 2.2 metres (7 ft. 3 in.). The form of the rim makes it possible to attach the tire to it very firmly, even with a slight shrinkage (⅛ to ¾ millimetre, or 0.036 inch for a wheel of 6 ft. diameter), on account of the large surface of contact which it presents. Moreover, the tire can be fastened upon the wheel in any manner whatever, as is indicated in the accompanying drawings. As these wheels can be pressed upon the axles with a pressure of 88,000 to 132,000 lbs., they require no keying.

This is doubtless one of the boldest applications of the trip hammer to die work. The wheel being wholly at a white welding heat, the stamping of it in one mass has the effect of forcing the soft material simultaneously into the cavities of the die, producing a uniform tension in all parts of the wheel; and as it cools slowly and equally throughout the mass, the molecules are everywhere in natural equilibrium, and thus those internal strains are avoided which are the inevitable consequence of successive forgings. This wheel is consequently annealed and possesses all the advantages of a forged mass.

In a word, until means have been found for running iron into a mould while preserving the properties of wrought-iron, the Arbel process remains the true method of obtaining a light, strong wheel, easy to make, and, above all, very economical.

There were shown at the Philadelphia Exhibition:

1. A wheel which had been submitted to the action of successive blows from a trip-hammer of 22,000 lbs. weight falling upon the rim from a height of one metre (3 ft. 3⅜ in.), entirely formed. The rim and the spokes were twisted, but not broken, and the welds had resisted very well, both at the rim and at the hub.

2. A wheel cut in half along the middle of the rim, in which no trace of the weld appeared, which indicated that the whole was perfectly homogeneous.

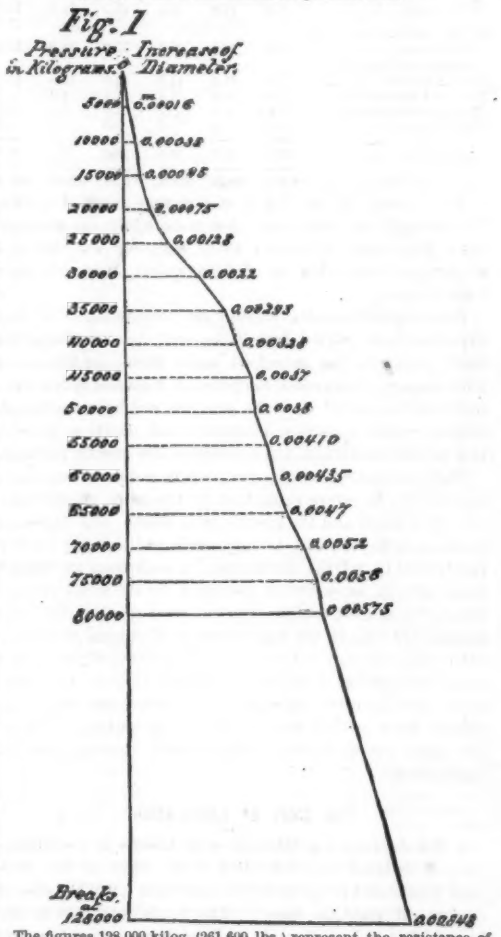
New experiments have just been made by the Paris, Lyons & Mediterranean Railroad Company, and also by the Artillery Commission. The results are shown in the following tables.

1. *Experiments made at Bourges on wrought-iron wheels for field artillery carriages.*

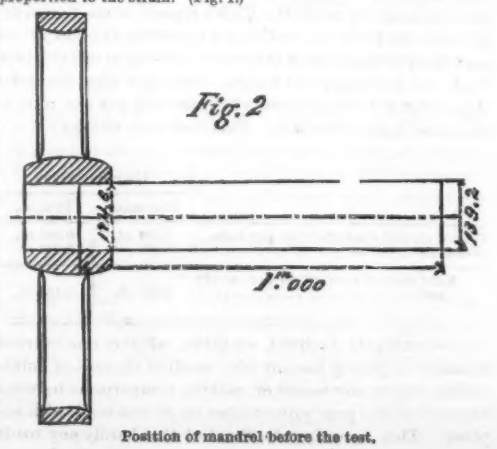
Calibre of gun, 95 millimetres (3¾ in.).
Weight of ball, 11 kilogrammes (24½ lbs.).
Charge of powder, 2.2 kilogrammes (4⅞ lbs.).
Total weight of carriage, 1,350 kilogrammes (2,970 lbs.).
Direction of aim, 7° 30′ below the horizon.
Number of shots fired, 40.

The wheel remained intact; after the firing it showed no trace of cleavage of weld or of bending.

2. TESTS MADE WITH HYDRAULIC PRESS ON A CAR-WHEEL HUB. (Paris, Lyons & Mediterranean pattern, 1874.)



The figures 128,000 kilog. (261,600 lbs.) represent the resistance of the hub at the instant of breaking. The elongation is obviously in proportion to the strain. (Fig. 1.)

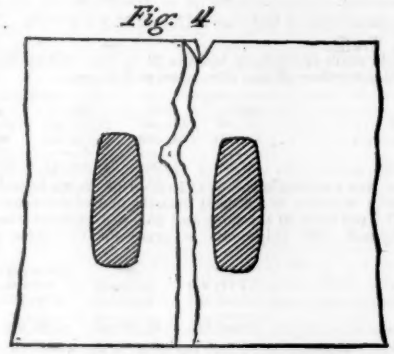


Position of mandrel before the test.

Fig. 3

Position of mandrel when the hub broke.

Fig. 4



Fracture of the hub in plan: ¼ size.

Fig. 5

Fracture of the hub, elevation.

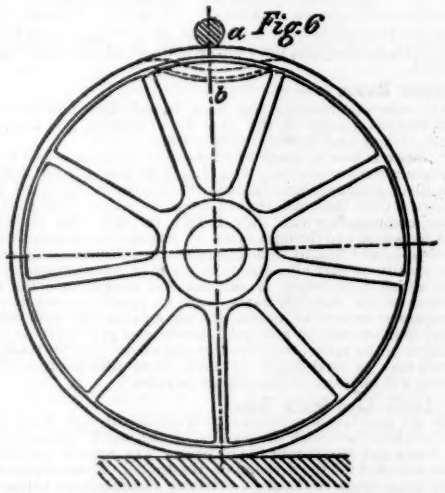
(Fracture at *a*.)

3. TESTS MADE ON A CAR WHEEL WITH A TRIP HAMMER.

(Paris, Lyons & Mediterranean pattern.)

Weight of hammer, 2,500 kilog. (= 5,500 lbs.)
Height of fall, 0.500 m. (= 20 in.)

Fig. 6



1. *Wheel placed vertically, the trip hammer striking at a.* (Fig. 6.)
First blow bends upper part of rim 22 millimetres (0.88 in.).
Second " " " " " 48 " (1.92 in.).

(Rim cracked inside.)

Third blow bends upper part of rim 52 millimetres (2.08 in.).

(Rim split at *a b*.)

There was no deflection of the lower part of the rim. The blow was transmitted to the rim through a cylinder 50 millimetres (2 in.) in diameter.

2. *Same wheel placed vertically, the trip hammer striking at a.* (Figs. 7 and 8.)

Weight of trip hammer, 2,500 kilog. (5,500 lbs.)
Height of fall, 350 millimetres (14 in.).

(The dotted line indicates the form of the wheel just before it broke.)

Fig. 7

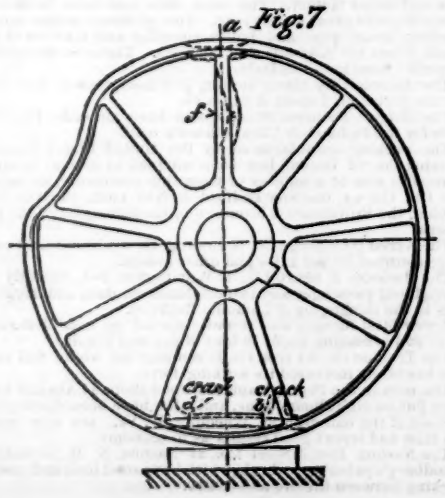
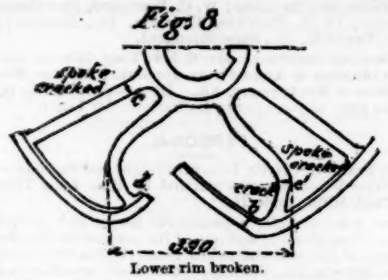


Fig. 8



Lower rim broken.

No. of Hammer Blow.	Deflection of upper part of rim.		Deflection of lower part of rim.		Total Deflection.		Deflections of vertical spoke.	
	mm.	in.	mm.	in.	mm.	in.	mm.	in.
Blow 1	..	..	16	0.64	16	0.64	..	..
" 2	..	..	23	0.92	23	0.92	..	..
" 3	2	0.08	28	1.12	30	1.20	..	..
" 4	4	0.16	32	1.28	36	1.44	..	..
" 5	6	0.24	33	1.32	39	1.56	1	0.04
" 6	8	0.32	34	1.36	42	1.68	3	0.12
" 7	10	0.40	36	1.44	46	1.84	3½	0.14
" 8	11	0.44	39	1.56	50	2.00	4	0.16
" 9	12	0.48	42	1.68	54	2.16	5	0.20
" 10	13	0.52	48	1.92	61	2.44	6	0.24
" 11	14	0.56	54	2.16	68	2.72	7	0.
" 12	15	0.60	59	2.36	74	2.96	8	0.
" 13	15	0.60	74	2.96	89	3.56	8	0.
" 14	15	0.60	85	3.40	100	4.00	8	0.

At blow 10 the rim cracked at *a* and *b* (Fig. 6).
At blow 14 the rim was broken at *a* (Figs. 6 and 7), and two spokes were cracked, one at *c* and the other at *c'*.

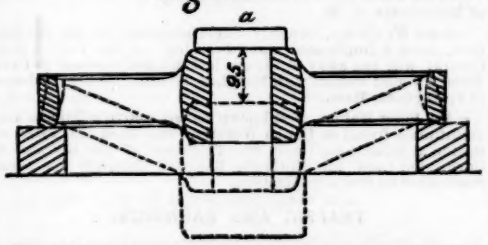
The hammering was then continued until all the spokes were broken. All the welds of the spokes resisted, both at the rim and at the hub.

4. TESTS OF A CAR WHEEL MADE WITH TRIP HAMMER.

(Paris, Lyons & Mediterranean pattern.)

Weight of hammer, 10,000 kilog. (22,000 lbs.)
Height of fall, 100 millimetres (4 in.).

Fig. 9



Wheel placed horizontally, the trip hammer striking at *a* and tending to force the hub from the rim. The dotted line indicates the form of the wheel at the instant the spokes broke.
Spoke on the left in elevation of hub broken half in two.

Fig. 10

No. of blows.	Deflection.		Observations.
	mm.	in.	
1	0	0	
20	18.5	0.34	
40	22.0	0.88	
60	40.5	1.62	1 spoke broken near hub.
90	95.0	3.80	6 spokes broken entirely, 1 half broken, 2 intact.

All the welds resisted well and the rim had the form of a truncated cone after the test.

DIFFERENT METHODS OF FASTENING THE TIRE TO THE WHEEL.

Fig. 11

Fig. 12

Fig. 13

Fig. 14

Fig. 11. Used on French railroads for cars, tenders and engines.
Fig. 12. Used on the Orleans Railroad for tenders and engines.
Figs. 13 and 14. Used on English and German railroads for cars, tenders and engines.
Most European railroads also use the system illustrated in fig. 11 (tire fastened to the wheel by rivets) for cars, tenders and engines.

COMPARISONS OF THE COST OF DIFFERENT WHEELS.

1. *Cast-iron Wheel with Chilled Tread.*

Cost of rough wheel from foundry, 605 lbs. @ $2.72½ per 100 lbs.	$16 50
Interest at 7 per cent. on this sum for one year	1 16
Pressing off old and fitting new wheels	1 14
Total	$18 80
Deduct for the old wheel, 550 lbs. @ $1.09 per 100 lbs.	6 00
Difference	$12 80

Or 32 cents per 1,000 miles for the first year.

2. *Sax & Kear Wheel.*

The tire is assumed to last three years and to run 120,000 miles.

Cost of a rough wheel from the foundry, 550 lbs., at $2.72½ per 100 lbs.	$15 00
Price of steel tire, 330 lbs., at $3.65 per 100 lbs.	12 00
Interest at 7 per cent. on this sum for three years	5 67
Taking off old and fitting new wheel	1 14
Total	$33 81
Deduct for the old wheel, 660 lbs @ $1.09 per 100 lbs.	7 20
Difference	$26 61

Or 22.2 cents per 1,000 miles run at the end of the third year.

3. *Krupp Wheel.*

This wheel is assumed to last five years and to run 200,000 miles.

Cost of a wheel, 944 lbs. @ $5.47 per 100 lbs.	$51 60
Interest on this sum at 7 per cent. for five years	18 06
Taking off old and fitting new wheel	1 14
Total	$70 80
Deduct for the old wheel, 726 lbs. @ $1.09 per 100 lbs.	7 92
Difference	$62 88

Or 31.4 cents per 1,000 miles run at the end of the fifth year.

4. *Arbel Wheel.*

This wheel has, so to speak, an illimitable durability. Wheels in service for 20 years on all the French and European railroads are in perfect condition and will be able to serve as many more years. The standard load of these wheels is about 7,700 lbs. We will assume that a wheel can wear out five tires, and that the average run of each of these tires is about 200,000 miles,

56,250 before the first turning.
46,875 after " first "
40,025 " " second "
31,250 " " third "
25,000 " " fourth "

It often happens that after rendering the service of 200,000 miles required by the railroad companies, the tire is not yet reduced to the mimimum thickness of one inch, which is cause for casting it aside, and that it continues to serve for a long time.

Cost of a wheel, 253 lbs. @ $4.55 per 100lbs.	$11 50
Cost of steel tire, 220 lbs. @ $6.36	14 00
Cost of five rivets	0 30
Interest on this sum for five years at 7 per cent.	9 03
Fitting tire once, removing tire once and turning tire three times	4 00
Total	$38 83
Deduct for the old tire, 275 lbs. @ $1.09 per 100 lbs.	3 00
Difference	$35 83

Or 17.9 cents per 1,000 miles run at the end of the fifth year.

Years of service.	Miles run.	Total Cost.				Cost per 1,000 Miles Run.			
		Cast-iron wheel with chilled tread.	Sax & Kear system). Steel tire.	Cast-iron wheel with steel tire. (Krupp's system).	Steel wheel cast with its tire. (Krupp's system).	Spoke wheel with steel tire. (Arbel's system).	Cast-iron wheel with chilled tread.	Sax & Kear wheel.	Krupp wheel.	Arbel wheel.
							Cts.	Cts.	Cts.	Cts.
1	40,000	$12 80	$27 00	$51 60	$25 80		31.2	65.5	124.8	62.4
2	80,000	26 50	.....	.....	.....		32.1	.....	.....	.....
3	120,000	41 15	26 61	.....	.....		33.4	21.2	.....	.....
4	160,000	56 82	.....	.....	.....		34.3	.....	.....	.....
5	200,000	73 60	.....	114 10	50 80		35.9	.....	56 2	24.4
6	240,000	91 44	57 97	.....	.....		37.1	23.0	.....	.....
7	280,000	110 54	.....	.....	.....		38.3	.....	.....	.....
8	320,000	131 04	.....	.....	.....		39.9	.....	.....	.....
9	360,000	152 94	90 91	.....	.....		41.2	25.0	.....	.....
10	400,000	176 18	.....	193 40	78 70		42.8	.....	46.8	19.0
11	440,000	201 30	.....	.....	.....		44.3	.....	.....	.....
12	480,000	228 10	130 75	.....	.....		45.5	26.8	.....	.....
13	520,000	256 86	.....	.....	.....		47.4	.....	.....	.....
14	560,000	287 58	.....	.....	.....		49.9	.....	.....	.....
15	600,000	320 40	177 00	287 10	111 50		51.8	28.7	46.8	18.1
20	800,000	518 60	305 11	397 40	163 20		63.0	37.4	48.4	20.0
25	1,000,000	774 00	420 50	522 60	206 30		74.0	40.9	53.0	20.0
30	1,200,000	1,104 60	616 87	676 80	253 30		89.6	49.9	56.2	20.6

LUCIEN ARBEL.

RIVE DE GIER, France, March 31, 1877.

Query in Train Dispatching.

TEXAS, June, 1877.

TO THE EDITOR OF THE RAILROAD GAZETTE:

On June 17 at noon a new time card took effect on the Houston & Texas Central Railway.

On the old time card No. 3 was due to leave Sherman at 11:47 and arrive at Denison 12:15 p. m.

On the new card it should leave Sherman at 10:33 and arrive at Denison at 11 a. m.

Denison is a terminus.

No. 3 has right of road over every train but No. 4, which wa not due to leave until 3:25 p. m. on the old and 4 p. m. on the new schedule.

The question is whether No. 3 had the right to leave Sherman on the old card and run into Denison without an order, or whether it should have stayed at Sherman for an order.

If the wires had been down would No. 3 have been justified in completing its run on the old card?

I argue that no order was required for No. 3, because there was no schedule train opposing and no special could leave without an order, which the train dispatcher would not give without ascertaining the position of No. 3. Also the new time card did not go into effect until No. 3 was midway between Sherman and Denison. No. 3 was therefore entitled to complete its run.

NEMO.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

Alabama Central.—Mr. W. L. Lanier has been re-elected President.

Anderson, Lebanon & St. Louis.—Mr. L. A. Millbank, of New York, has been chosen President. He is also General Manager of the Ontario Southern and Superintendent of the Port Jervis & Monticello Railroad.

Atlanta & Charlotte Air Line.—Mr. C. D. Wall, late of the Western of Alabama, has been appointed Master Mechanic, with office in Atlanta, Ga.

Atlantic & Great Western Mutual Life Insurance Association.—At the annual meeting in Dayton, O., June 19, the following officers were chosen: President, A. L. Dunbar, Meadville, Pa.; Vice-President, J. B. Shaw, Salamanca, N. Y.; Secretary, G. E. Hinds, Kent, O.; directors, J. T. Fosdick, Salamanca, N. Y.; T. G. Armstrong, Jamestown, N. Y.; H. C. Thompson, W. B. Clay, J. H. Holway, Meadville, Pa.; Myron Wood, F. M. Baker, Youngstown, O.; J. M. Ferris, W. G. Haggard, Cleveland, O.; S. V. Smith, C. H. Thorp, Kent, O.; J. W. Holmes, H. A. Cooper, Galion, O.; T. H. B. Beach, Urbana, O.; John Hardy, Dayton, O.

Atlantic & North Carolina.—At the annual meeting in Newbern, N. C., June 28, the following directors were chosen by the stockholders: C. R. Thomas, Edward R. Stanly, Wm. Butler Duncan, John Patterson. The State directors (appointed some time ago) were announced as follows: A. J. Galloway, Jas. F. Wooten, Jas. M. Parrott, Geo. Allen, John Hughes, Jas. S. Lane, Silas Webb, J. H. Davis. The board elected John Hughes, President; W. H. Oliver, Secretary and Treasurer. The Finance Committee is composed of J. J. Wolfenden, Jas. A. Bryan, J. C. Wooten, chosen by the stockholders; John L. Morehead, Chas. Allen, chosen by the board.

Charlotte, Columbia & Augusta.—Mr. Thomas Anderson is appointed Master of Machinery, in place of Robert King, who has resigned to accept a position on the Western Railroad of Alabama.

Connecticut Central.—Mr. T. M. Maltbie has been chosen Secretary and Treasurer, in place of John W. Stoughton, resigned.

East Tennessee, Virginia & Georgia.—The title of Mr. John F. O'Brien, whose appointment was noted last week, is Chief Engineer and Assistant Superintendent. All communications having reference to road department as well as those referring to Superintendent's duties will in future be addressed to him.

Freehold & New York.—The first board of directors of this new company is as follows: Samuel B. Brown, Herbert C. Felton, Telfair Hodgson, Joseph B. Hoff, Theodore M. Morris, Samuel Osborn, Justus E. Ralph, John J. Schultze, Wm. R. Schultze, Wm. H. Vredenburg, Wm. A. Wells, Charles M. Wiley, Hiram B. Willetts.

Hannibal & St. Joseph.—At a meeting held in New York, June 30, Messrs. David Jones, A. W. Greenleaf and Horace W. Porter were chosen directors in place of W. H. Neilson, F. C. Billings and B. F. Carver, resigned.

Long Island.—Mr. Adolph Poppenhusen has been elected President, in place of D. N. Ropes, resigned.

Louisville & Nashville.—The following circular is dated June 28:

"For the purpose of reducing expenses, and to simplify the working of the line, the Clarksville and Memphis divisions, heretofore operated under separate managements, will be consolidated. Jas. Montgomery, Esq., is appointed Superintendent of the mechanical and transportation departments of the line between Memphis Junction and Memphis. John T. Flynn, Esq., Superintendent of Memphis Division, is appointed General Agent of this company at Memphis, vice H. F. Smith, deceased. Appointments to take effect July 1, 1877.

"On and after July 1 officers of the road department between Memphis Junction and Memphis will report direct to the Chief Engineer, who will issue further instructions in detail reference to that department."

Marietta, Pittsburgh & Cleveland.—The purchasers at the foreclosure sale have appointed Mr. S. C. Baldwin Manager of the road. Mr. Baldwin was at one time in charge of the Chicago & Milwaukee road, and long Superintendent of the Peninsula Division of the Chicago & Northwestern, where he made an excellent reputation.

Marietta & Cincinnati.—The Ohio Court of Common Pleas has appointed John King, Jr., late President, Receiver, on application of the fourth-mortgage bondholders.

The board has elected John Waddle, of Chillicothe, O., President, in place of John King, Jr., resigned.

Marquette, Houghton & Ontonagon.—Mr. James S. Mott is appointed Assistant General Manager.

Nebraska.—Mr. Wm. Irving has been appointed General Superintendent. He will continue to act as General Superintendent of the Burlington & Missouri River Railroad in Nebraska also, and will retain his office in Omaha.

Northern Central Michigan.—At the annual meeting in Albion, Mich., June 21, the following directors were chosen: T. J. Charlesworth, Lansing, Mich.; J. M. Crane, Eaton Rapids, Mich.; S. V. Irwin, W. H. Brockway, W. O'Donohughue, Albion, Mich.; H. B. Payne, Cleveland, O.; W. J. Baxter, Jonesville, Mich.; John Newell, Chicago; Augustus Schell, E. D. Worcester, New York. The road is leased to the Lake Shore & Michigan Southern, forming its Lansing Division.

Philadelphia & Atlantic City.—Mr. J. W. Gore is appointed General Passenger Agent in anticipation of the opening of the road soon.

Port Royal.—Mr. T. S. Davant having resigned his position to go to the Memphis & Charleston road, General Superintendent R. G. Fleming will, for the present, act as General Freight and Passenger Agent.

Rochester, Nunda & Pittsburgh.—At the annual meeting in Rochester, N. Y., June 28, the following directors were chosen: F. D. Lake, George Osgoodby, Nunda, N. Y.; C. L. Bingham, Mount Morris, N. Y.; J. C. Cochrane, G. W. Aldrich, Rochester, N. Y.; T. Guilford Smith, Buffalo, N. Y.; George Jerome, S. M. Simpson, Detroit, Mich.; J. Leavitt, Philadelphia.

St. Paul & Duluth.—This company, successor to the Lake Superior & Mississippi, was organized at St. Paul, Minn., June 27, by the election of the following directors: J. P. Ilsley, Wm. H. Rhawn, Edwin M. Lewis, George Whitney, E. A. Rollins, F. R. Shelton, James Smith, Jr., Wm. Dawson, C. H. Graves. The board elected J. P. Ilsley, President; Wm. H. Rhawn, Vice-President; Thomas M. Davis, Secretary and Treasurer.

Spartanburg, Union & Columbia.—Col. James Anderson has been appointed General Superintendent. He has been for some years General Superintendent of the Charlotte, Columbia & Augusta and the Wilmington, Columbia & Augusta roads. He will take charge July 15.

Spartanburg & Asheville.—Col. James Anderson is appointed General Superintendent from July 15. He will also hold the same position on the Spartanburg, Union & Columbia, as noted elsewhere.

State Line & Sullivan.—At the annual meeting in Towanda, Pa., June 14, the following directors were chosen: N. N. Betts, Jr., E. T. Fox, Towanda, Pa.; George D. Jackson, Dushore, Pa.; W. N. Whelen, Alfred Jones, Philadelphia; W. S. Slater, Providence, R. I.; R. H. Rochester, New York. The board elected N. N. Betts, Jr., President; W. C. Townsend, Providence, R. I., Treasurer; O. A. Baldwin, Towanda, Pa., Secretary; J. O. Blight, Towanda, Pa., Superintendent.

Western, of Alabama.—Mr. Robert King, late of the Charlotte, Columbia & Augusta, is appointed Master Mechanic, with office in Montgomery, Ala. He succeeds Mr. C. D. Wall, who has gone to the Atlanta & Charlotte Air Line.

PERSONAL.

—Mr. Frank B. Clarke, General Freight and Passenger Agent of the West Wisconsin, was married to Miss Lena Thompson, in St. Paul, Minn., June 27.

—Hon. John A. Dale, a prominent lawyer and politician of Western Pennsylvania, and one of the projectors and strongest advocates of the still unfinished Pennsylvania Petroleum road, died in Tionesta, Pa., June 27. His death resulted indirectly from injuries received in a collision on the Philadelphia & Erie road at Westport, in August, 1871.

—Hon. Ginery Twichell, formerly for several years President of the Boston & Worcester, and from the consolidation until the last election a director of the Boston & Albany, was married at Ithaca, N. Y., June 28, to Mrs. Vinal, of that city, and shortly afterwards started for California on a wedding trip. The new Mrs. Twichell is a sister of Gen. Wm. Burt, formerly President of the Utica, Ithaca & Elmira, and now of the Boston, Hoosac Tunnel & Western.

—A statement having been widely circulated that Hon. Frank Abbott, of Port Jervis, N. Y., Treasurer of the Insurance Association of the Brotherhood of Locomotive Engineers, was a defaulter in a large amount, the Port Jervis *Union* contradicts it. Mr. Abbott recently agreed to loan about $8,000 of the funds of the Association on bond and mortgage on property in Sullivan County, N. Y. Expecting this to be approved as a matter of course, he advanced the money, but the directors afterward declined to accept the mortgages and he was unable to return the money at once.

—Mr. J. J. Grafton, Assistant Superintendent of the Detroit, Lansing & Northern road, has been appointed warden of the new House of Correction at Ionia, Mich.

—Mr. George H. Gramling, la e Master Mechanic of the Atlanta & Charlotte Air Line, has been presented with a silver service by the men lately under his charge. The presentation took place at his residence in Atlanta, Ga., June 30.

—Mr. John F. Burnap, formerly Superintendent of the Nashua, Acton & Boston Railroad, was struck by lightning and killed as he was sitting reading in his house at Dunstable, N. H., on the evening of July 1. His wife, who sat near him, was not injured.

—Mr. V. D. Perry, for 23 years Master Car Builder of the Hartford, Providence & Fishkill Railroad, resigned his position July 1. Mr. Perry is a prominent member of the Master Car-Builders' Association.

—Col. A. S. Johnson, Land Commissioner of the Atchison, Topeka & Santa Fe, was married recently to Miss L. A. Scott, of Manchester, N. H.

—John W. Phelps, formerly Superintendent of the Springfield, Athol & Northeastern and President of the Connecticut Central, who ran away to Europe last fall and was said to have taken a young woman with him, has returned to his residence in Springfield, Mass.

—Mr. Peter Harvey, best known as an active politician and an intimate friend of Daniel Webster, who died last week in Boston at an advanced age, was Treasurer of the Rutland & Burlington (now the Rutland) Railroad Company for some years after its first organization.

TRAFFIC AND EARNINGS.

Railroad Earnings.

Earnings for various periods are reported as follows:

	1877.	1876.	Inc. or Dec.		P. c.
Five months ending May 31:					
Louisville, Cincinnati & Lexington	$421,877	$402,532	Inc..	$19,345	4.8
Atchison, Topeka & Santa Fe	850,940	859,161	Dec..	8,221	1.0
Net earnings	372,199	436,734	Dec..	64,535	14.8
Per cent. of exps.	56.26	49.17	Inc..	7.09	14.5
Four months ending April 30:					
Chi., Rock Island & Pacific	$2,138,484	$2,099,501	Inc..	$38,983	1.9
Month of April:					
Chi., Rock Island & Pacific	$615,177	$506,431	Inc..	$108,746	21.5
Month of May:					
Louisville, Cin. & Lexington	$90,675	$89,085	Inc..	$1,590	1.8
Third week in June:					
Atchison, Topeka & Santa Fe	$55,316	$50,300	Inc..	$5,016	10.0
Denver & Rio Grande	14,174	.....	.....	.....	....
St. Louis, Iron Mt. & Southern	76,400	71,054	Inc..	5,346	7.5
Week ending June 15:					
Great Western, of Canada	$63,520	$69,910	Dec..	$6,390	9.1

The Denver & Rio Grande reports that coal traffic was stopped during the week, owing to a strike of the miners.

Norfolk Cotton Traffic.

June receipts of cotton at Norfolk were 5,959 bales, an increase of 211 bales, or 3½ per cent. over 1876. For the ten months of the cotton year from Sept. 1 to June 30 the receipts were:

	1876-77.	1875-76.	Increase.	P. c.
Atlantic, Miss. & Ohio R. R.	218,637	202,162	16,475	8.1
Seaboard & Roanoke R. R.	250,307	218,061	32,246	14.8
Canal and otherwise	41,557	40,391	1,166	2.9
Total, bales	510,501	460,614	49,887	10.8

Of the total this year 156,456 bales were consigned to Norfolk and 354,045 to points beyond, against 139,357 bales local and 321,257 bales through, last year.

Coal Movement.

Coal tonnages for the week ending June 23 are reported as follows:

	1877.	1876.	Inc. or Dec.	P. c.
Anthracite	439,924	151,844	Inc.. 288,080	189.7
Semi-bituminous	64,955	70,080	Dec.. 5,115	7.3
Bituminous, Pennsylvania	33,162	39,493	Dec.. 6,331	16.0

The Cumberland tonnage has been considerably decreased by the strike of the boatmen on the Chesapeake & Ohio Canal which still continues.

A curious feature of the anthracite trade is that coal can now be bought at ruling prices in New York and shipped to Buffalo by canal for less than the prices fixed by the Anthracite Association at that port. Including all charges there is an advantage of from 35 to 72 cents per ton on coal shipped in this way from New York over standard prices for coal carried by rail to Buffalo. This will enable the Reading to compete with the Northern companies, which have heretofore had all the lake business.

Some small shipments of coal have been received in San Francisco from a mine near Oonalaska in Alaska and a company, known as the Kimberly Coal Co., has been organized to work the mines regularly. The coal is of a good quality and is said to exist in great quantity there.

Large deposits of coal varying but slightly from the Lykens Valley anthracite of Pennsylvania are said have been discovered near the line of the Little Rock & Fort Smith road in Arkansas. Some small workings have been opened and it is proposed to extend these, chiefly with a view to supplying the steamboat demand on the Arkansas and Mississippi.

Erie Canal.

The business of the canal at Buffalo from the opening up to July 1 was as follows:

	1877.	1876.	Decrease.	P. c.
Boats cleared	1,394	1,480	86	5.8
Tolls received	$88,714 16	$184,173 65	$95,459 49	51.8

The canal opened May 8 in 1877, and May 4 in 1876.

Grain Traffic.

Buffalo grain receipts up to June 30, as reported by the *Commercial Advertiser* of that city, were as follows:

	Flour.		Grain.	
	1877.	1876.	1877.	1876.
By lake	173,089	168,384	11,124,007	14,417,928
By rail	511,300	544,600	6,140,740	6,650,700
Totals	684,389	712,984	17,264,747	21,068,628

There was a decrease this year in flour of 28,595 barrels, or 4 per cent.; in grain, of 3,803,881 bushels, or 18.1 per cent. This year, 74.7 per cent. of the flour and 35.6 per cent. of the grain came by rail. The shipments of grain for the same period were:

	1877.	1876.	Decrease.	P. c.
By canal	7,711,313	8,710,193	998,880	11.5
By rail	2,146,443	4,027,156	1,880,713	46.7
Total	9,857,756	12,737,349	2,879,593	22.6

The rail shipments were 21.8 per cent. of the whole this year, against 31.6 per cent. last year. The canal opened May 8 in 1877, and May 4 in 1876.

Baltimore grain receipts for June were:

	1877.	1876.	Inc. or Dec.	P. c.
Flour, barrels	43,654	89,180	Dec.. 45,526	51.0
Wheat, bushels	152,397	104,414	Inc.. 47,983	46.0
Corn	1,108,149	3,117,906	Dec.. 2,009,757	64.5
Other grain	93,372	74,000	Inc.. 19,372	26.2
Total, bushels	1,572,188	3,742,220	Dec.. 2,170,032	58.0

For the six months ending June 30 the receipts were:

	1877.	1876.	Decrease.	P. c.
Flour, barrels	510,103	678,709	168,606	24.8
Grain, bushels	14,458,993	16,247,162	1,788,169	11.0
Total, bushels	17,009,508	19,640,707	2,631,199	13.4

The exports of flour in June were 46,791 barrels. The stock of corn in elevator June 30 was 921,401 bushels.

Grain Movement.

Receipts and shipments of grain of all kinds for the week ending June 23 were, in bushels:

	1877.	1876.	Decrease.	P. c.
Lake ports' receipts	2,475,641	3,886,980	1,411,339	36.2
" " shipments	2,881,932	4,926,760	2,044,828	41.5
Atlantic ports' receipts	2,079,976	5,128,251	3,048,275	59.5

Of the shipments from lake ports, 27 per cent. were by rail this year, against 44⅛ per cent. in 1876, 38 in 1875 and 16¾ in in 1874.

Freight Rates.

The following circular has been issued, signed by the General Freight Agents of the New York Central, the Erie, the Pennsylvania and the Baltimore & Ohio:

"Notice is hereby given to all railroad companies and transportation lines connecting with the New York Central & Hudson River Railroad, Erie Railway, Pennsylvania Railroad, Baltimore & Ohio Railroad, that in order to secure uniformity in rates, commencing with July 1, 1877, through bills of lading will be issued and through rates of transportation guaranteed on west-bound freight from Eastern seaboard cities, only under the conditions that all connecting roads or transportation lines over which such freight is shipped will charge their full proportion of the through rates, make no special contracts with shippers or owners of goods, pay no rebates, and hold out no other inducements of any kind, amounting practically to a reduction in the rates established by the above named roads, or which may be established by them from time to time. Due notice will be given of any change in rates."

St. Louis Live Stock Rates.

At the meeting of representatives of the through lines held in Cleveland last week the pooling of the stock business from St. Louis and Mississippi River points was agreed on, and a basis adopted for the division of the traffic. It was decided to keep rates from St. Louis, Louisiana, Hannibal and Quincy to all common points east of Cleveland at five cents per 100 lbs. above the Chicago rates. A committee was appointed to see that the agreement is carried out.

THE SCRAP HEAP.

Railroad Manufactures.

Swift's Iron & Steel Works, at Cincinnati, have been running the rail trains for six months past on 30, 35 and 40-lbs. T rails for narrow-gauge roads and a few orders for 60-lbs. rails. They have also large orders for locomotive boiler iron and special irons for bridges, roof-trusses, etc.

At a joint meeting of the State Board of Public Works and the County Commissioners of Sandusky County in Columbus, Ohio, June 28, the contract for the iron bridge over the Sandusky River at Fremont was awarded to the King Iron Bridge Co., of Cleveland, O., the price being $14,775.05.

The Asbestos Packing Co., of Boston, have just moved into a new and larger factory. The sales this year have been over three times as great as last year. The company makes steam packing, steam pipe and boiler covering and mill-board for steam joints for railroads and factories. The asbestos used is imported from mines in Italy.

The Kansas City (Mo.) Rolling Mill is at work on iron rails for the Atchison, Topeka & Santa Fe.

The Edgar Thomson Steel Works have an order for steel rails for the Paducah & Elizabethtown road.

The packing manufactured by the United States Metallic Packing Co., of Boston, has been adopted by several leading railroads; also by a number of steamship companies, including the Old Colony, the New Bedford & New York, the Old Dominion, the Providence & Stonington, the Albany Day Line and others.

The Akron (O.) Forge Co. is running its works full time on a large contract for car axles and other orders.

The Jackson & Sharp Co., at Wilmington, Del., recently delivered four passenger and two combined smoking and baggage cars to the Burlington & Lamoille Railroad.

A new blast furnace was recently started up near Jefferson, Tex., and is making about 10 tons of pig iron per day.

The Trenton (N. J.) Iron Co. is running its works full time and has lately increased its working force.

The men in the Pennsylvania Railroad shops at Altoona have been put on eight hours' time, and a few have been discharged.

Some of the nail mills at Wheeling, W. Va., are now using old rails and report good results as to economy.

The Nashua Iron & Steel Co., at Nashua, N. H., is making Woodbury's patent car wheels, which have steel tires and rubber packing between the tire and centre.

The Susquehanna Rolling Mill, at Columbia, Pa., is running full double turn and in May made more iron than in any month since it was started.

Buff & Berger, of Boston, manufacturers of surveying and scientific instruments, are making a large improved astronomical theodolite for Princeton College.

Claflin, Sheldon & Co., at Cleveland, O., employ a small force and are making some street cars for Manchester, N. H., and some bridge irons.

The Baldwin Locomotive Works have just delivered one of their separate street engines to the Newark & Bloomfield Horse Railroad Co., at Newark, N. J.

The Wythe Speed Recorder Co. has put five more of its railway speed recorders on trains on the Mahoning Division of the Atlantic & Great Western, which makes 76 in use on that road. The Buffalo, New York & Philadelphia Company has adopted the speed recorder and put one in each caboose on the road.

The Oscoda (Mich.) Salt & Lumber Co. has contracted to furnish the Chicago & Northwestern with 200 wooden bridge chords. These chords or stringers will average 70 feet long and much care is required to select the logs from which they are made.

Tramps.

Many uses have been found lately for refrigerator cars, but preserving tramps is the latest. The Jamestown (N. Y.) *Journal*, of recent date, says:

"As the conductor on the night freight train which reaches here about midnight, was looking over his train at Meadville he discovered that a refrigerator car, filled with meat for Europe, had been broken into. He locked up the car and the train pulled out. It was not long, however, before the seven tramps who, unknown to the conductor, had taken possession of the refrigerator, make noise enough to be easily heard above the racket of the train. As the thin garments with which they were clad afforded little protection against the frozen atmosphere of the refrigerator car, they could not and would not stand the congealing process without rebelling. The conductor was in sore straits, and at Union telegraphed back to Meadville for orders. The return message directed him to have them arrested at Corry. Reaching Corry, the solitary policeman did not dare to tackle the seven half-frozen tramps, and so a second message passed over the wire and a second return said to capture the dangerous characters at Jamestown. Arriving here, our night watchman, Mr. Charles Nerrill, hesitated not to face the car-door and claim as his 'meat' the seven culprits who, altogether too happy to get out of their uncomfortable prison, followed the officer without resistance, to the city bastile."

Missouri, Kansas & Texas Car Report.

The Master Car Builder of this road reports for May as follows:

	Passenger.	Loaded freight.
Cars per train	4.2	14.4
Total mileage of trains	60,021	103,450
Cost of car repairs per train mile	7.35 cts.	8.10 cts.
Total mileage of cars	262,608	1,574,670
Cost of repairs per car mile	1.87 cts.	0.53 ct.
Total cost of repairs	$4 414 03	$8,374 68
Mileage of Pullman cars	25,950	.....
Cost of Pullman car repairs per mile	2.44 cts.	.....

The total cost of the Car Department for the month, including all expenses, was $12,788.71. The credit for old scrap sold was $829.63, being 0.41 cent per engine mile, or 0.04 cent per car mile. In computing freight mileage three empty cars are rated as two loaded ones.

OLD AND NEW ROADS.

Atchison, Topeka & Santa Fe.

The Treasurer's report for May and the five months ending May 31 is as follows:

	May.	Five months.
Freight earnings	$121,713 97	$550,668 80
Passenger	61,245 15	264,037 10
Express, mail and miscellaneous	6,955 77	36,234 01
Total	$189 914 88	$850,939 91
Operating expenses	108,138 66	478,741 39
Net earnings	$81,776 22	$372,198 52
Per cent. of expenses	56.95	56.26

For May there is a decrease of $29,454.97, or 13.4 per cent., in gross, and of $36,728.24, or 31 per cent., in net earnings. The five months show a decrease from 1876 of $8,221.22, or 1 per cent. in gross, and $64,535.07, or 14.8 per cent., in net earnings.

Atlantic & Great Western.

It will be remembered that about a year ago the suit of the United States Rolling Stock Company against this company was tried in the Ohio Court of Common Pleas and that the Court held that the contract on which the suit was based should be set aside, because the same parties were directors in both companies, and that only an equitable compensation for the use of rolling stock leased could be recovered. The case was carried to the District Court, which affirmed this ruling. The Rolling Stock Company then applied to the Supreme Court for a writ of error to reverse the decision. The Supreme Court has just overruled and refused to grant the motion for the writ of error, practically affirming the decision of the lower courts.

Atlantic & Great Western Mutual Life Insurance Association.

The annual meeting of this association was held in Dayton, O., June 19, about 125 members being present, out of a total of 629, a large attendance. The Secretary's report showed the receipts for the year were $3,085.24. This included initiation fees and sums collected by assessments. The disbursements made to the heirs of deceased members were $1,884. The expenses of the Association were $210.06, which left a balance in the Treasury of $941.18. It was also stated in the report that 140 new members had been added to the Association. There have been only 12 deaths since the formation of the Association.

After the reception of the reports officers were elected for the ensuing year. It was resolved to hold the next annual meeting in Lake View, N. Y., June 18, 1878. Resolutions of thanks to the officers of the Association and to General Superintendent Cooper for his interest in and help to the Association were passed and the meeting adjourned.

Atlantic & North Carolina.

At the annual meeting in Newbern, N. C., June 28, statements were made by Mr. Humphreys, the retiring President, and Receiver Hughes. The latter intimated that the road would be returned to the company and the receivership discharged at the September term of court, the necessity for it having passed. There was some discussion on the amendment made to the charter and some on other points was expected, but was cut short by an adjournment to Sept. 27.

Boston & Lowell.

The remainder (nearly $400,000) of the $750,000 loan authorized last year for the purpose of paying off or funding the floating debt has been taken by the banking firm of George Wm. Ballou & Co., of New York and Boston.

Burlington & Lamoille.

The track of this road is now laid to Cambridge Junction, Vt., 29 miles northeast from Burlington. At Cambridge connection is to be made with the Vermont Division of the Portland & Ogdensburg, now very nearly completed. Regular trains are expected to run between Burlington and Cambridge in a few days.

Buffalo, New York & Erie.

The new loan of $1,922,000 in 7 per cent. bonds offered by this company for the purpose of taking up an equal amount of old bonds which will mature Dec. 1, 1877, has been awarded to Perkins, Livingston, Post & Co., of New York at prices varying from 102.55 to 106.50 and accrued interest, payable in cash or in the old bonds at par and accrued interest. The total amount of proposals received was $2,688,000.

Cincinnati Southern.

It is announced that new subscriptions to the common carrier company's stock have been secured in place of those withdrawn to a sufficient amount to enable the company to take a lease of the completed section of the road and to operate the same. Negotiations have been opened with the trustees for a temporary lease or license to operate and it is thought that this can be arranged without difficulty.

Cleveland, Columbus, Cincinnati & Indianapolis.

This company follows the example of its neighbor, the Lake Shore, and orders a general reduction of 10 per cent. in the salaries and wages of all employes and officers. The reduction took effect July 1.

Columbus, Chicago & Indiana Central.

The trustees and receivers will pay at the office of A. Iselin & Co., No. 48 Wall street, New York, the coupons due Jan. 1, 1877, on Columbus & Indianapolis preferred first-mortgage, common first-mortgage and second-mortgage bonds, and on Columbus & Indianapolis Central first-mortgage bonds.

Colorado Springs & South Park.

A company by this name has been organized to build a railroad from Colorado Springs into the South Park and thence southwest through the Poncha Pass to the San Luis Valley in Saguache County. The capital stock is fixed at $3,000,000. The office of the company is at Colorado Springs, Colorado.

Coal Creek & New River

A company by this name has been organized to build a railroad from the Coal Creek mines in Anderson County, Tenn., northeast to a point on the Cincinnati Southern in Scott County. The distance is about thirty miles, through a somewhat difficult country. The incorporators are Henry W. Wiley, W. S. Geers, Edwin F. Wiley, W. J. Hornsby and Thomas J. Thomas.

Chesapeake & Ohio Canal.

The strike of the boatmen for higher rates on coal still continues. Last week the strikers collected some 40 boats near Hancock, Md., and effectually blockaded the canal, preventing the passage of all boats still running. On July 2, however, the company secured the aid of the sheriff, who collected a posse and forced the strikers to allow boats to pass. Very few are running, however, nearly all the boatmen who own or hire their boats having joined in the strike.

Denver & Rio Grande.

The track on the La Veta Branch is now laid to Grayback Gulch, 22 miles beyond La Veta, Cal., and 44 miles from the junction with the Main Line at Cucharas. This section carries the branch over the most difficult section, as from Grayback westward towards San Juan and Saguache there is a long section of tolerably level country, over which the work will be comparatively light.

Delaware, Lackawanna & Western.

At the regular monthly meeting of the board, held June 29, it was voted to execute a mortgage of $10,000,000 on the line owned by the company, to secure an equal amount of 30-year 7 per cent. bonds to bear date Sept. 1, 1877. Of these bonds $2,800,000 are to be held to redeem an equal amount of outstanding bonds which are now the only mortgage lien on the property. The rest are to be used as may be required for the company's purposes. The funded debt of the company has always been small; the new mortgage will be $51,282 per mile on the Main Line and Bloomsburg Division owned, making an annual interest charge of $3,590 per mile.

Dividends.

Dividends are announced as follows:

Pittsburgh, Fort Wayne & Chicago, 1¾ per cent., quarterly, on special guaranteed stock, payable July 2; 1¾ per cent., quarterly, on regular guaranteed stock, payable July 3.

Housatonic, 2 per cent., quarterly, on the preferred stock, payable July 14.

Pittsfield & North Adams (leased to Boston & Albany), 2½ per cent., semi-annual, payable July 2.

Cayuga & Susquehanna (leased to Delaware, Lackawanna & Western), 4½ per cent., semi-annual, payable July 2.

Denver Pacific.

A special dispatch from Denver, Col., to the St. Louis *Republican*, dated June 29, says: "The management of the Denver Pacific Railroad, after a protracted interview with our county commissioners yesterday, have entered into a written agreement granting about all that Denver asks, agreeing to pro-rate and furnish the Union Pacific every facility to the business in Colorado; to cut loose entirely from the Kansas Pacific's death-grip, reduce the fare, etc. For this the county agrees to let the application for a receiver stand in abeyance."

Erie.

Some time since Receiver Jewett applied to the Court for leave to terminate the exclusive contract of the company with the Western Union Telegraph Company, the object being to make a new contract for the use of the railroad wires by the Atlantic & Pacific Telegraph Company. The application was given to a referee to take testimony. Recently the Western Union put in an appearance and moved to set aside the order of reference, on the ground that action to break a valid contract was not allowable. The case was argued July 2, and decision reserved.

A strike of the employes on the western end of the road on account of the reduction in wages was thought probable last week, and violence was considered so probable that a militia regiment was called out at Rochester and one at Elmira to be in readiness to aid the civil authorities. No strike took place, however, and everything remains quiet on the road.

Freehold & New York.

A company by this name has been organized under the New Jersey general law for the purpose of building and operating a line from Freehold, N. J., to Keyport, 14¾ miles, and also of running a steam ferry between Keyport and New York, about 22 miles. The road was nearly all graded several years ago by the Monmouth County Agricultural Railroad Company, whose property was last year sold under bankruptcy proceedings. The new company is organized by the purchasers, who already have the road nearly completed.

Gilbert Elevated.

Work on this road was begun last week on the upper part of Sixth avenue, New York, but was stopped in a few days by an injunction sued out by a property-owner on the avenue. The ground of the injunction was that the company had settled upon one plan for building its road and had afterwards adopted another plan without warrant of law.

Grand Rapids & Lansing.

A survey is being made for this road, and meetings have been held along the line to secure subscriptions. The road is intended to run from Grand Rapids, Mich., a little south of east to Lansing, about 60 miles. It will pass through a section already well supplied with railroads and could not be anywhere over 10 or 12 miles from some existing road.

Harrodsburg & Southwestern.

The town of Harrodsburg, Ky., has voted $20,000 in aid of a line about 10 miles long from that town south by west to the nearest point on the Cincinnati Southern.

Hannibal & St. Joseph.

It will be remembered that the announcement was made some months since that this company's land-grant bonds had been paid off, and that the company had made formal application to the courts for an order to terminate the trust and transfer the assets, some $2,500,000 in land notes and contracts and 100,000 acres of land, to the company. The proceedings were had in Massachusetts, where the trustees reside, and the application was opposed by the State of Missouri, on the ground that the trust should be continued and its assets applied to the payment of the bonds issued by the State in aid of the road. The Court has just overruled the opposition and decided to grant the company's application, the case being referred to a master to ascertain the amount of assets and audit the accounts of the trustees. The finding of the Court is as follows:

"By the eighteenth section of the statute of Missouri of Dec. 10, 1855, the plaintiff is not required to pay to the State of Missouri the whole of 'the proceeds of all land sales or such other securities as may be provided by the company, in a deed of trust or otherwise, in a plan to be adopted by said company to raise funds to complete the road.' The plaintiff is required to pay to the State only the surplus of such proceeds, 'after the Hannibal & St. Joseph Railroad shall be completed, equipped and in operation.' The necessary implication is that only so much of such proceeds is to be paid to the State as remains after deducting the amount of all expenses and obligations lawfully incurred by the corporation in completing, equipping and putting in operation its railroad, and that the amounts so to be deducted must include

"*First*—Sums advanced by the corporation to the trustees for expenses of the management, surveying and disposing of the lands granted under the Act of Congress and included in the deeds of trust, and for taxes thereon, and to satisfy reclamations on bad titles and other incidental expenses.

"*Second*—Sums paid, either in money or in stock, to discharge the bonds insured by the corporation and secured by the deeds of trust, including interest on such bonds.

"*Third*—Sums paid and obligations incurred by the plaintiffs to other than the State to raise money to complete its road."

It is announced that the assets of the trust, as soon as transferred, will be placed with the Union Trust Company, of New York, for the benefit of bondholders.

Hartford, Providence & Fishkill.

The trustees have ordered a reduction in wages, varying from 10 to 20 per cent. It took effect July 1.

Houston & Texas Central.

When the holders of coupons on the first-mortgage bonds due July 1, received payment for them, in accordance with an advertisement that these coupons would be bought for Charles Morgan by John J. Cisco & Son as his agents, each received the following notice, signed John J. Cisco & Son:

"Please to take notice that the gold coupons of the first mortgage bonds of the Houston & Texas Central Railway Company due July 1, 1877, received from you at our banking house, are so received upon condition that they are sold to and purchased by order and for account of Charles Morgan, AND NOT for account of the Houston & Texas Central Railway Company."

Kent County.

An effort is being made to secure the extension of this road from Belair, Md., to Rock Hall, on Chesapeake Bay, a distance of eight miles. Rock Hall has a steamboat landing with abundant depth of water, and the intention is to establish a line from that point to Baltimore in connection with the railroad.

Louisville, Cincinnati & Lexington.

The Auditor's report for May is as follows:

	1877.	1876.	1875.
Passenger earnings	$36,228 14	$39,199 82	$46,230 83
Freight	47,225 40	42,911 30	36,349 71
Express, mail, etc.	7,221 47	6 973 53	6,691 15
Total	$90,675 01	$89,084 74	$89,271 69
Expenses and renewals	61,806 62	61,163 90	64,692 87
Net earnings	$28,868 39	$27,920 84	$24,578 82
Taxes, rentals and improvements	6,530 54	7,916 34	8,299 37
Net profits	$22,337 85	$19,934 50	$16,279 45

The earnings this year were $436 gross, and $139 net per mile; expenses and renewals were 68.16 per cent. of gross earnings. The change in the relative amount of passenger and freight earnings is noticeable, the two having changed places in three years.

Lake Superior & Mississippi.

The purchasers of this road at the recent foreclosure sale met in St. Paul, Minn., June 27, and organized a new corporation to be known as the St. Paul & Duluth Railroad Company. The road is in the hands of the Purchasing Committee, and will probably be transferred to the new corporation soon.

Lexington & St. Louis.

This road was recently sold in bankruptcy proceedings and a new company organized. It is now stated that the Missouri Pacific, which has always operated the road, has concluded a ten-years' lease of the property from the new company. The road extends from Lexington, Mo., to Sedalia, 55 miles.

Lake Shore & Michigan Southern.

The following order is dated June 27 and was issued on the following day:

"To the officers and employes of the Lake Shore & Michigan Southern Railroad Company: On and after July 1, 1877, a reduction of 10 per cent. will be made in the present compensation of all officers and employes of every grade in the service of the company, where the amount received exceeds 10 cents per hour, $1 a day, or $30 per month, but in cases where 10 per cent. would reduce the pay of the hour men below 10 cents per hour, daily men $1 per day, or employes of other classes below $30 per month, the pay of such shall be fixed at 10 cents per hour, $1 per day, and $30 per month respectively."

Montgomery & Eufaula.

A meeting of bondholders was held in New York, June 27, at which, after a long private session, it was decided to appoint a committee of five with full power to take such action as they might decide to be best to protect the bondholders' interests in view of the coming sale of the road.

Massachusetts Central.

The Boston *Commercial Bulletin* says: "The Massachusetts Central Railroad Company has, after long negotiations, made a contract with Mr. Nathan Matthews for the purchase of the bonds held by him on that road, and a further contract with Mr. Munson for the completion and equipment of the road,

which it is expected will be put in running order within a year. The Boston public will soon be invited to subscribe capital in some form."

Marietta & Cincinnati.

In the Court of Common Pleas of Ross County, at Chillicothe, O., June 27, a petition was filed against this company by the trustees of the fourth mortgage of the company, alleging a default in the payment of the interest on the bonds secured by that mortgage and asking for the appointment of a receiver. Judges Steele and Minshall, after hearing the application and the proofs in support of the same, appointed John King, Jr., Receiver in the case, with power to operate and manage the road and its branches and to hold and control its property during the pendency of the suit, under the direction of the court. The court, among other things, ordered the payment, in addition to current expenses, of back pay rolls and wages and material and supply bills made within four months last past, and also taxes and the rent due or to become due to the Cincinnati & Baltimore Railway Company for the use of its tracks and such other rents as were necessary to preserve the rights of the company in its leased property.

Mr. King is Vice-President of the Baltimore & Ohio and is also Receiver of the Ohio & Mississippi; he was until very recently President of the Marietta & Cincinnati. It is well known that the road does not earn and has not earned the interest on its debt and that it has been able to pay interest only by advances made by the Baltimore & Ohio. That company has declined to continue these advances, and it is understood that the company will be reorganized as soon as possible.

Missouri, Kansas & Texas.

The Union Trust Company, of New York, Trustee, will pay $20, gold, on each of the coupons maturing July 1, 1877, on those bonds of the Union Pacific Railway, Southern Branch, which have been stamped as subject to the agreement of March 1, 1876.

Meetings.

Meetings are announced as follows:

Chicago, Danville & Vincennes, Indiana Division bondholders, to hear report of committee, at No. 50 Wall street, New York, July 10, at noon.

Central Pacific, annual meeting, at the office in San Francisco, July 10.

Raleigh & Gaston, annual meeting, at the office in Raleigh, N. C., July 19, at noon.

Raleigh & Augusta Air Line, annual meeting, at the office in Raleigh, N. C., July 20, at noon.

Mobile & Ohio.

The final decree granted by the United States Circuit Court for Alabama appoints James Gillette and Thomas H. Herndon special masters to sell the road and instructs them to advertise the sale, in satisfaction of the first mortgage, provided the amounts due are not paid by the company or the holders of the inferior mortgages prior to Aug. 1. The sale is to be advertised eight weeks, so that the sale cannot take place before the end of September. The decree provides that the purchaser, if the road is sold, must pay $5,000 in cash and must furnish such further amount in money as may be needed to pay all costs and the money dividend due to bondholders not participating in the purchase; the balance may be paid in bonds. If the property is bought for the parties joining in the agreement of Oct. 1, 1876, they shall permit all bondholders who desire to do so to join with them until Sept. 1, 1877. The decree further provides that the coupons of May and November, 1874, paid and now held by Alexander Duncan shall be held to have an equal lien with all other overdue coupons. With regard to the lien of the Tennessee substitution bonds on the 118 miles of road in Tennessee, an exception is made, the Court holding that it cannot decide the question, which is now pending before another Court. A reservation is also made as to the prior mortgage existing on the Gainesville Branch.

The Ketchum party gave notice of appeal, which the Court allowed, but required an appeal bond for $100,000 to be filed to cover any damages which might result from the delay consequent to the appeal.

In the United States Circuit Court for Tennessee the argument on the prior lien claimed for the Tennessee substitution bonds was completed June 23, and the case taken under advisement. The decision will probably not be given until the September term.

New Orleans Pacific.

A report lately issued by this company gives the length of the projected road from Bayou Goula, La., the terminus of the New Orleans, Mobile & Texas, to Marshall, Tex., at 263 miles, with a branch of 25 miles from Keachi to Shreveport. The estimated cost of the road complete, without equipment, is $3,537,600. From Bayou Goula to Alexandria, 117 miles, there is an old graded road-bed for all but 25 miles of the distance, and the present company has graded about one-third of the line between Alexandria and Shreveport.

The company has only secured subscriptions amounting to $354,600, of which $301,240 have been paid in, $27,210 are in course of collection and $26,150 considered uncollectable. Of the amount paid in all has been expended in surveys and construction except a cash balance of $2,733.23.

The President complains of the bitter opposition made to the company, which has succeeded in defeating the proposed 5 per cent. tax in aid of the road in New Orleans.

A New York Central and Erie Pool.

The New York Central & Hudson River and the Erie companies have concluded an agreement under which all traffic between New York and Rochester and points in New York State west of Rochester is to be pooled, and an equitable division made of all local business to and from points at which the two roads compete. The two lines meet at Rochester and Buffalo and nearly all the intermediate towns of any importance, and their competition has usually kept rates pretty low, and for about a year past the Erie has made special rates for Rochester, Buffalo and Niagara Falls $2 or more lower than the Central's rate. Some increase of rates is probable under the new arrangement, although the canal will prevent the making of high rates on heavy freights.

New York Central & Hudson River.

A general reduction of wages took effect July 1. The reduction is 10 per cent. and includes all officers and employes of the road, except that no wages or salaries are reduced below 10 cents per hour, $1 per day, or $30 per month.

New Hampshire General Railroad Law.

One of the most important measures before the New Hampshire Legislature is a general law authorizing and regulating the formation of railroad companies and the construction of new railroads. It meets with much opposition, which is locally attributed partly to the existing companies and partly to certain persons who have heretofore made money by securing charters from the Legislature and then selling them out to the company or companies with whose business the projected line was likely to interfere.

Ohio & Mississippi.

On July 2 default was made for the second time in the interest on the first-mortgage bonds. By the terms of the mortgage the trustees may commence foreclosure proceedings after the interest has been in default six months, and must do so if required by the holders of $500,000 or more of the bonds. It is said that a private meeting was lately held in New York by several large bondholders and that it was then resolved to require the trustee to foreclose.

The second-mortgage bondholders are now preparing to take some action to protect their interests in the property, and it is thought probable that they may make some arrangements to advance the money to pay off the interest on the first-mortgage bonds to protect themselves from the loss which would result from the foreclosure of the first mortgage. In case they take such action, it is probable that they will proceed to foreclose their own mortgage.

Peoria & Rock Island.

The United States Circuit Court has authorized Receiver Hilliard to borrow $45,000 from R. R. Cable to pay the back taxes due on the property. In case the recent sale of the road to Mr. Cable is confirmed, the money so borrowed shall be considered a part of the purchase money.

Queens County.

This company, which was organized several years ago, but has done no work as yet, recently applied to the New York Supreme Court for a commission to condemn the right of way for the road on Lafayette avenue in Brooklyn, through which the road is to run. Opposition was made by the property-owners, but the Court decided to grant the order for a commission, leaving, however, some questions as to the company's right to run through the avenue at all to be settled hereafter. The road is intended to run from the East River in Brooklyn to Jamaica, eight miles.

St. Louis, Kansas & Colorado.

The convention to advocate the construction of this projected road met in St. Louis, June 27, a large number of delegates being present from St. Louis and from towns and counties in Central and Southern Missouri and Southern Kansas, with some from Arkansas and Colorado. A number of letters and telegrams were received from places which could not send delegates. The morning session was devoted to organization and the usual preliminary work, Mr. Chauncey I. Filley, of St. Louis, being chosen President. The afternoon session was occupied by the presentation of various lines proposed for the road and argument thereon, and by the presentation and discussion of resolutions. At the close of the proceedings a resolution was passed providing for the appointment of an executive committee of 25 to continue the work of the convention after its adjournment and to make the necessary arrangements for the legal organization of a company.

The second day's session was also occupied with the presentation of various routes for the road, the discussion over which grew very warm towards the last. Besides the projected main line numerous branches were advocated, and many offers were made of subscriptions. Most of the delegates from outside of St. Louis, however, seemed to think that city should bear the burden of the work.

The convention finally adjourned, subject to the call of the Chairman of the Executive Committee.

After the adjournment of the convention, the Executive Committee met to receive written statements as to the claims of the various routes advocated. Arrangements were made to collect statistics of the traffic of the country and other information bearing upon the proposed road. Finally the Executive Committee also adjourned subject to call, after appointing a sub-committee consisting of Hon. Erastus Wells, Chairman; Giles F. Filley, L. C. Norvell, John B. Maude and Edward Morrison, to prepare an address setting forth the advantages of narrow-gauge roads generally and of the proposed St. Louis lines, and to organize such company or companies as may be required to carry out the objects proposed.

St. Louis, Kansas City & Northern.

A reduction of 12½ per cent. in the salaries and wages paid by this company has been ordered and took effect July 1.

St. Martins & Upham.

On this road, which is to extend from St. Martins, N. B., to the Intercolonial at Upham, 30 miles, work is progressing well. There are now 22 miles graded and 5 miles of track laid; most of the bridges are done and the ties ready. An engine and a number of flat cars have been put on the road.

Seattle & Walla Walla.

This company has concluded an agreement with the Seattle Coal Company to build a branch or extension of its road from the present terminus at Renton, Wash. Ter., to the coal mines at Newcastle, a distance of 6¼ miles. The road is to be completed by Oct. 15, and the company further agrees to carry all the coal furnished from the mines to the port of Seattle at fixed rates for 20 years. On the other hand the Seattle Coal Company is to transfer its locomotives to the Seattle & Walla Walla Company and also makes some advances. Work on the extension has already begun.

Terre Haute & Indianapolis.

This company and the Indianapolis & St. Louis, worked under one management, have also joined in the general reduction and cut down wages 10 per cent. on July 1. Much opposition has been manifested by the employes, and the yardmen at East St. Louis left work soon after the announcement was made. Several meetings of the other employes have been called, to consider what action they should take under the circumstances.

Talbotton & Geneva.

A survey is to be made for a railroad from Talbotton, Ga., southward to Geneva, about eight miles. Talbotton is the county seat of Talbot County and Geneva is on the Columbus Line of the Southwestern Railroad.

Union & Chester.

It is proposed to build a narrow-gauge railroad from Union, S. C., on the Spartanburg, Union & Columbia road, west about 25 miles to Chester, to connect there with the Chester & Lenoir Railroad.

Union Pacific.

It is stated that President Dillon has agreed to secure the completion of the Colorado Central extension from Longmont, Col., to Cheyenne, Wy. Ter., and to make Cheyenne the junction of the Black Hills Branch with the Main Line, on condition that Laramie County, Wyoming, votes a subsidy of $350,000 in county bonds.

Wabash.

This company publishes the following: "Notice to the holders of the first mortgage bonds of the Toledo and Illinois Railroad, in Ohio; of the Lake Erie, Wabash & St. Louis Railroad, in Indiana; of the Great Western Railroad, in Illinois; of the Illinois & Southern Iowa Railroad, in Illinois: Out of $6,200,000, the total amount of these bonds, about $5,600,000 have accepted the funding scheme, and funded their coupons. The holders of the remaining bonds are requested to fund their coupons in accordance with the circular issued Jan. 24, 1877. The coupon due on Aug. 1 on the above bonds will be paid on that date to all those who have complied with the terms of that circular."

Washington & Ohio.

The suit recently begun against this company is by holders of the old Alexandria, Loudoun & Hampshire bonds, on which no interest has been paid for several years, and for which the holders claim a lien prior to the Washington & Ohio general mortgage. The company claims, on the other hand, that these holders long ago agreed to exchange their bonds for the general mortgage bonds, and further that they obtained them on certain conditions which they have not carried out.

Wisconsin Central.

Recently Seymour & Alexander, of Chicago, applied to the United States Circuit Court at Milwaukee for an injunction to restrain the Phillips & Colby Construction Company from transferring this road, now completed, to the Wisconsin Central Railroad Company. Argument on the application was heard last week, and the Court reserved its decision.

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Flint & Pere Marquette.

This company owns and works the following lines:

	Miles.
Main Line, Monroe, Mich., to Ludington	253.02
Flint River Branch, Flint River Junction to Otter Lake	14.47
St. Clair Branch, Junction to South Saginaw	3.94
Bay City Branch, East Saginaw to Bay City	12.35
Total	283.78

The side tracks amount to 51.63 miles; guard-rail on bridges to 0.89 mile, equivalent in all to 336.30 miles single track. There are 40.98 miles of main track laid with steel. The equipment consists of 43 engines and 2 snow-plows; 27 passenger, 2 sleeping, 2 parlor, and 11 baggage, mail and express cars; 297 box and stock, 417 flat and 7 caboose cars; 1 directors', 8 boarding, 1 derrick, 1 pile-driver, 1 bridge-tool, 75 hand and 64 lorrie cars. One engine and one passenger car were added during the year. The report is for the year ending Dec. 31, 1876.

The company has a land-grant of 511,502 acres, from which 270,344 acres have been sold, only 7,538 acres in 1876. The receipts on land account for the year were $136,591.08, of which $68,972.30 were applied to cancel bonds. The lands are held in trust for the canceling of the land-grant bonds of the company.

The liabilities at the close of the year were as follows:

Stock ($11,622 per mile)	$3,298,200 00
Bonded debt ($24,533 per mile)	6,961,905 50
Floating debt ($3,074 per mile)	872,314 82
Total ($39,229 per mile)	$11,.32,420 32

Of the floating debt $693,019.35 is in the form of notes payable drawing interest. Some progress has been made in funding the floating debt, bills payable having decreased $306,617.33 during the year. The bonded debt was decreased by $73,000 land-grant and $184,074.97 construction bonds and increased by $261,000 consolidated bonds, a net increase of $3,925.03.

The past due and unpaid coupons on Dec. 31 amounted to $689,285, of which $283,300 have been funded and for most of the rest deferred scrip has been taken. Since that time $84,750 have been paid on account of maturing coupons. The arrangement with the bondholders provided for the resumption of payment on the consolidated bonds in May, 1878, and on the prior bonds in January, 1877. It is now evident that these dates were fixed too early, and further negotiation with the bondholders will be required.

The train mileage for the year was:

	1876.	1875.	Inc. or Dec.	P. c.
Passenger	391,408	494,939	Dec.. 103,531	20.9
Freight	366,861	366,035	Inc .. 826	0.2
Miscellaneous	193,835	267,990	Dec.. 74,155	27.7
Total	952,104	1,128,964	Dec.. 196,830	6.6

The comparative operations for 1874, 1875 and 1876 were as follows:

	1874.	1875.	1876.
Number of passengers carried	465,518	493,384	466,439
Number of tons of freight	347,646	346,115	339,767
Lumber, in feet, board measure	86,675,000	96,959,000	95,184,000
Staves	2,377,600	969,600	1,643 200
Shingles	257,640,000	224,160,000	19 ,200,000
Lath	5,520,000	7,735,000	2 205,000
Wheat, lbs	14,504,400	15,873,900	17,309,200
Agricultural products, lbs	35,434,700	39,760,500	39 011,000
Products of animals, lbs	6,700,000	8,997,800	8,869,300
Merchandise, lbs	169,627,700	118,391,400	128,164 600
Salt, bbls	115,892	101,220	73,798
Plaster, tons	1,595	984	932
Logs, in feet, board measure	6,533,930	14,648,872	5,346,000

The earnings for the year were:

	1876.	1875.	Inc. or Dec.	P. c.
Passengers	$366,128 56	$404,259 54	Dec..$38,130 98	9.4
Freight	573,748 05	581,174 60	Dec.. 7,426 55	1.3
Mail and express	35,765 69	36,712 48	Dec.. 946 79	2.6
Rent and interest	24,726 05	32,907 10	Dec.. 8,181 05	24.9
Total	$1,000,368 35	$1,055,053 72	Dec..$54,685 37	5.2
Expenses	634,294 06	696,455 70	Dec.. 62,161 64	8.9
Net earnings	$366,074 29	$358,598 02	Inc .. $7,476 27	2.1
Gross earnings per mile	3,525 12	3,717 86	Dec.. 192 74	5.2
Net earnings per mile	1,289 99	1,263 65	Inc .. 26 34	2.1
Per cent. of exps	63.40	66.01	Dec.. 2.61	4.0

The expenses include the cost of raising 1¼ miles of the Bay City Branch and about a mile at other points; 12.11 miles steel and 1.61 miles new iron rails. The income account was as follows:

Balance, Dec. 31, 1875	$130,214 39
Net receipts, land sales	68,972 30
Bonds solds	281.000 00
Bills receivable and personal balances	35,317 76
Rolling stock, net profit on cars built and sold	2,563 91
Credit to construction, citizens of Monroe	6,000 00
Real estate	24,575 47
Net earnings	366,074 29
Total	$914,918 12
Coupons, taxes and interest	$142,122 20
Construction and buildings	14,790 76
Profit and loss, discount and claims	12,812 30
East Saginaw & St. Clair advances	3,774 62
Bonds canceled	257,074 97
Bills payable	306,617 33
Trustees, for coupons and advances	87,158 89
Banks, for coupons due	12,120 43
	836,471 50
Balance, Dec. 31, 1876	$78,446 62

Of this balance $78,405.61 is in supplies and materials on hand and $41.01 cash.

The report says: "The policy of the management has been to maintain the property in good condition, to operate economically, and to apply the net earnings where a careful study of the necessities of the property, and the rights of the several classes of securities, seemed to require and warrant. As one result of this policy the track and equipment are, today, in a condition far superior to that of two years ago, and the road is in position to handle economically any probable traffic that an improvement of general business is likely to throw upon it.

"The net earnings of 1876, after deducting all sums expended for construction, were more than enough to pay all coupons on the bonds of the company, except the consolidated. They were not, however, so applied, for the reason that arrears of indebtedness for labor and for materials used in constructing and operating (a class of obligations which has priority under any form of reorganization) were very pressing.

"Since July, 1876, a fund has been set aside to provide for payment of coupons of senior bonds. From this fund, up to and including March 1, 1877, coupons have been paid as they matured, to the amount of $125,000 00."